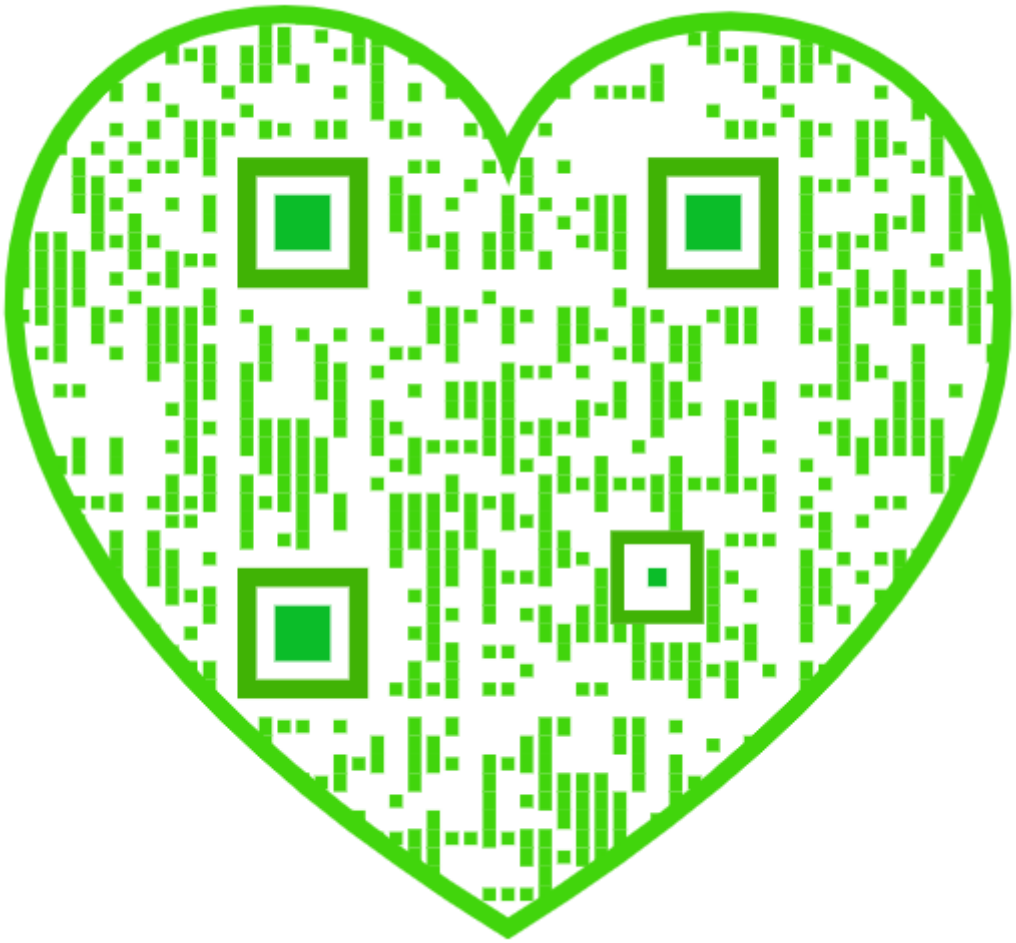
THE HORSE
AND ITS RELATIVES

R. LYDEKKER, F.R.S.



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THE HORSE
AND ITS RELATIVES

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THE HORSE
and
ITS RELATIVES

BY

R. LYDEKKER, F.R.S.

AUTHOR OF

"THE GAME ANIMALS OF AFRICA," "THE GAME ANIMALS OF INDIA, ETC.," "THE DEER OF ALL LANDS," "A GEOGRAPHICAL HISTORY OF MAMMALS," "THE OX AND ITS KINDRED," ETC.

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PREFACE

THE following popular, and yet, I hope, scientifically accurate, account of the natural history of the more important representatives of the horse family, inclusive of the older domesticated breeds and its extinct forerunners, will, I venture to think, appeal to a large circle of readers. For breeders, racing men, antiquarians, naturalists, and big-game hunters ought all to find something of interest.

It should be emphasised that only the natural aspect of the subject is dealt with, such side-issues as the legendary history of the horse, horse-sacrifice, the acquisition and development of the art of riding and driving, the training and management of horses, being left untouched.

ERRATUM

Page 29, line 14 from top, *for* 'cement' *read* 'dentine.'

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PREFACE

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Several difficult and debatable points are purposely left undecided, as I have preferred to quote the various opinions expressed by different writers, rather than to assert my own views.

For the illustrations I am especially indebted to the Trustees of the British Museum; but I have also to express my acknowledgments to the Duchess of Bedford, Prof. R. S. Lull, Dr. E. L.

Trouessart, Mr. Theodore A. Cook—both in his private capacity and as editor of *The Field*—Prof. J. C. Ewart, and several other friends and correspondents.

Since the text was in type, Mr. R. I. Pocock has pointed out (*The Field*, Jan. 20, 1912, p. 143) that the aperture of a scent-gland situated on the posterior aspect of the hind-foot of the Indian rhinoceros occupies a position very nearly similar to that of the ergot in the foot of the horse (*infra*, p. 41). "The orifice of this gland," he writes, "is placed suggestively near the spot corresponding to that occupied by the ergot in horses, and despite the accepted view that the ergot is a sole of the foot, the possibility of its representing an aborted gland may be wisely borne in mind. Its general resemblance to the warts or chestnuts on the legs of horses, which most authorities regard as degenerated glandular structures, is quite in keeping with this suggestion."

R. LYDEKKER.

HARPENDEN LODGE, HERTS,
January 1912.

CONTENTS

CHAP.		PAGE
I.	The Zoological Position and Structure of the Horse	1
II.	The Wild Tarpan and its Relations	71
III.	Horses and Ponies of the British Islands	117
IV.	Some Foreign Breeds	136
V.	The Arab Stock	150
VI.	Feral Horses	170
VII.	The Kiang and Onager Group	176
VIII.	Zebras and Quaggas	187
IX.	The Ass	215
X.	Mules and other Hybrids	225
XI.	The Extinct Forerunners of the Horse	239
	Index	283

ILLUSTRATIONS

PLATES

PLATE | FACING PAGE

I. Fig. 1. Cannon and Splint Bones of Shire Horse 14
(*Brit. Mus. Guide to Horse Family*)

Fig. 2. Bones of Fore and Hind Feet of "Miohippus" . . . . . ,,
(*After* Lull)

II. Skeleton of Thoroughbred Stallion "Eclipse" 16
(Cook, "*Eclipse and O'Kelly*")

III. Fig. 1. Skeleton of Fore-limbs of "Eclipse" 18

Fig. 2. Skeleton of Hind-limbs of "Eclipse" ,,
s, scapula; *h*, humerus; *u*, ulna; *r*, radius; *c*, carpus (knee); *can*, cannon-bone; *ph*, phalanges; *p*, pelvis; *f*, femur; *t*, tibia; *ca*, calcaneum (hock)
(*Both from* Cook)

IV. Fig. 1. Skull of Shire Stallion . . . 22
(*Brit. Mus. Guide to Horse Family*)

Fig. 2. Skull of Quagga . . . . . ,,

V. Fig. 1. Right Upper Cheek-teeth of Tarpan 34

Fig. 2. Right Upper Cheek-teeth of Arab ,,
p.2–*p*.4, premolars; *m*.1–*m*.3, molars; *p*, anterior pillar; *hy*, posterior pillar

VI. Fig. 1. Hind-foot of Horse showing Ergot 44

Fig. 2. Chestnuts on Legs of Horse . . ,,
(*Both from* "*Brit. Mus. Guide to Horse Family*")

PLATE		FACING PAGE
VII.	FIG. 1. FRONTLET OF HORSE WITH HORN-LIKE PROMINENCES	60
	FIG. 2. PREHISTORIC TARPAN OR WILD HORSE (*Brit. Mus. Guide to Horse Family*)	,,
VIII.	FIG. 1. A MONGOLIAN MARE	88
	FIG. 2. A TARPAN MARE . . . . . (*Brit. Mus. Guide to Horse Family*)	,,
IX.	FIG. 1. SKULL OF TARPAN MARE	94
	FIG. 2. SKULL OF ARAB MARE . . . . (*Both from "Brit. Mus. Guide to Horse Family"*)	,,
X.	FIG. 1. A NORWEGIAN DUN STALLION . .	104
	FIG. 2. A MONGOLIAN POLO PONY . . . (*From "The Field"*)	,,
XI.	FIG. 1. NEW FOREST PONIES	118
	FIG. 2. SHETLAND PONIES . . . . . (*Both from photos. by* C. REID)	,,
XII.	FIG. 1. A SUFFOLK STALLION	128
	FIG. 2. A SHIRE STALLION . . . . . (*Photos. by* C. REID)	,,
XIII.	FIG. 1. A PERCHERON STALLION . . . . (*From a French Journal*)	138
	FIG. 2. A BELGIAN STALLION . . . . . (*From a Brussels Journal*)	,,
XIV.	FIG. 1. THE DARLEY ARABIAN . . . . (*From the Picture at Aldby Park*)	152
	FIG. 2. THE THOROUGHBRED STALLION "PERSIMMON" . . . . . (*From "The Field"*)	,,

PLATE — FACING PAGE

XV. FIG. 1. THE KIANG 178

FIG. 2. KOBDO ONAGER . . . . . ,,
(*Both from "Brit. Mus. Guide to Horse Family"*)

XVI. FIG. 1. GRÉVY'S ZEBRA 188
(*Brit. Mus. Guide to Horse Family*)

FIG. 2. HEAD OF GRÉVY'S ZEBRA . . . ,,

XVII. FIG. 1. THE QUAGGA 194
(*Photo.* YOUNG)

FIG. 2. MATABILI BONTEQUAGGA . . . ,,
(*Photo.* PROF. J. C. EWART)

XVIII. FIG. 1. KILIMANJARO BONTEQUAGGA . . 200
(*Photo.* THE DUCHESS OF BEDFORD)

FIG. 2. MASAI BONTEQUAGGA . . . . ,,
(*Brit. Mus. Guide to Horse Family*)

XIX. FIG. 1. SKIN OF FOA'S ZEBRA 210

FIG. 2. SKIN OF KILIMANJARO BONTEQUAGGA . ,,
(*Photos.* DR. E. L. TROUESSART)

XX. FIG. 1. THE ZEBRA 214

FIG. 2. NUBIAN WILD ASS . . . . . ,,
(*Both from "Brit. Mus. Guide to Horse Family"*)

XXI. FIG. 1. HYBRID BONTEQUAGGA AND PONY FOAL AND DAM 234
(*Photo.* PROF. EWART)

FIG. 2. HYBRID ZEBRA AND ONAGER . . ,,

XXII. BONES OF FORE-FEET OF EXTINCT FORE-RUNNER OF THE HORSE 246
(*Brit. Mus. Guide to Horse Family*)

PLATE FACING PAGE

XXIII. SKELETON OF "HIPPIDIUM" 252
(*Brit. Mus. Guide to Horse Family*)

XXIV. FIG. 1. SKULL OF "ONOHIPPIDIUM" . . 260

FIG. 2. MOLARS OF "EQUUS," "HIPPIDIUM," AND "HIPPARION" . . . . . ,,
(*Both from "Brit. Mus. Guide to Horse Family"*)

TEXT-FIGURES

PAGE

BONES OF FORE-LEG OF HORSE AND RHINOCEROS . . 6
(*Brit. Mus. Guide to Great Game*)

SKULL OF PIG-LIKE ANIMAL, "ELOTHERIUM" . . 20

MOLARS OF SINGLE-TOED AND THREE-TOED HORSES . 33

THE ANCESTORS OF THE HORSE AND ITS RELATIVES COMPARED 240
(*After Lull*)

MILK-MOLARS AND PREMOLARS OF THE EXTINCT "MERYCHIPPUS" 255
(*After Lull*)

BONES OF THE FORE AND HIND FEET OF THE EXTINCT "HIPPARION" 257
(*After Lull*)

CROWN SURFACE OF UPPER MOLAR OF THE EXTINCT "HIPPARION" 258
(*After Lull*)

BONES OF THE FORE AND HIND FEET OF THE EXTINCT "HYPOHIPPUS" 261
(*After Lull*)

UPPER MOLAR TOOTH OF "ANCHITHERIUM" . . 267

BONES OF THE FORE AND HIND FEET OF THE EXTINCT "EOHIPPUS" 274
(*After Lull*)

BONES OF THE FORE AND HIND FEET OF THE EOCENE "PHENACODUS" 276
(*After Lull*)

THE HORSE AND ITS RELATIVES

CHAPTER I

THE ZOOLOGICAL POSITION AND STRUCTURE OF THE HORSE

THE difficulty which occurs in the case of the ox[1] as to what is the proper English designation of that animal does not arise in the present instance, for although we not infrequently speak of a horse, as distinct from a mare, there seems little doubt that the former term is really a species-name, and therefore applicable to both sexes of *Equus caballus*, as the domesticated horse of Europe was called by Linnæus.

As to the origin of the name horse—the equivalent of the Anglo-Saxon *hors*, the Frisian *hars* or *hors*, the German *ross*, the Italian *rozza*, the Old Saxon and Old German *hros*, and probably the Persian *ghor* and the Hindustani *ghora*—there has been some difference of opinion. It has been stated, for instance, to take origin from the Sanskrit

[1] See *The Ox and its Kindred*, by R. Lydekker, London, 1912.

hrēsh, signifying to neigh, so that the horse means the neighing animal.[1] This derivation is, however, not admitted in the *Century Dictionary*, where the name is stated to be the equivalent of the Anglo-Saxon *hors*, which signifies swiftness, and is connected with the Latin *currere*, to run; the English term horse thus meaning the running animal.

The Sanskrit name of the species is *açva*, which appears to be the equivalent of the Hebrew *sûs*, the Greek *hippos* (with its diminutives *hipparion* and *hippidion*), and the Latin *equus*. Another series of names for the horse is represented by the Greek *kaballos*, the Latin *caballus*, the Spanish *caballo*, the Italian *cavallo*, and the French *cheval*. In addition to these, we have the German *pferd* and the Dutch *paard*. There is also the English name *pony*, for a small horse, which may possibly be connected with the undermentioned *pullus*.

As is commonly the case with domesticated animals, there is also a large series of names to denote the two sexes and the young of the horse. Stallion, for instance, the English name of the male of the species, is equivalent to the modern French *étalon*, the old French *estallon*, and the Italian *stallone*, or *equus stallonis*, the horse at stall. Mare, the designation of the female, is derived

[1] See *The Student's English Dictionary*, by J. Ogilvie, London, 1865.

from the Anglo-Saxon *myre* or *mere*, a word which appears to have been originally connected with increase, but in a later sense indicated the female of the strong animal. As regards the young, the name foal—equivalent to the Anglo-Saxon *fole*, the Latin *pullus*, and the Greek *pôlos*, all denoting originally a young animal—is applicable to both sexes. The word filly, on the other hand, which likewise apparently comes from the Anglo-Saxon *fole*, denotes a female foal; whereas colt—an Anglo-Saxon derivative probably connected with *cild*, a child—is applied solely to a foal of the male sex. Finally, the term gelding signifies the castrated male.

In this place it may be convenient to mention that although the name horse properly belongs only to the domesticated and wild representatives of *Equus caballus*, it is frequently employed by naturalists in a more extensive sense. We speak, for instance, of the Arabian horse; and even if that be, as some suppose, specifically distinct from the ordinary horse of Western Europe, there is no question that such usage is perfectly legitimate and permissible. On the other hand, all the other existing members of the horse tribe, or *Equidæ*, have distinctive names of their own, such as ass, zebra, and quagga. Nevertheless, all these are often called horses in works on natural history, although the practice has its inconveniences; and the term

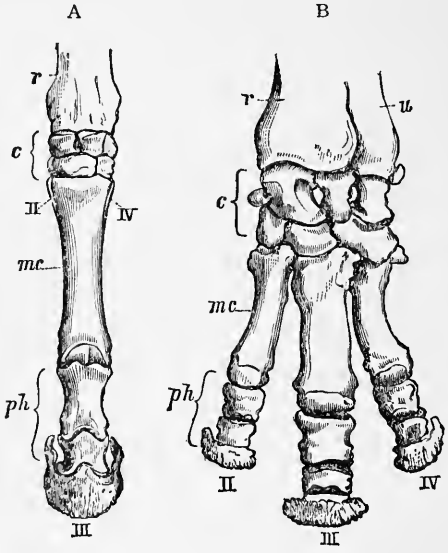
members of the horse tribe is preferable. Similarly, the name horse, as the denomination of the typical member of the genus *Equus*, is very generally applied to the extinct representatives of the same genus or even of closely allied genera; and there is less objection to this practice than to the one last mentioned, as there are no vernacular names for the animals in question. The term three-toed horses is, for instance, a convenient one for the members of the extinct genus *Hipparion*, as it is not likely to lead to confusion. On the other hand, the word horse must have some limitation; and the American practice of applying it to diminutive ancestral types of the *Equidæ* no larger than foxes is one that is not to be commended. Since the respective meanings of the terms species, genus, family, order, &c., are explained in most works on natural history, it will suffice in this place to state that *Equus caballus*, as represented by the ordinary domesticated horses of Western Europe, is the typical representative of both the genus *Equus* and the family *Equidæ*. Both that family and the *Bovidæ*, or hollow-horned ruminants—of which the ox is the typical member—belong to the great order of hoofed mammals, or Ungulata, so called from the feet of its more typical representatives being encased in solid horny hoofs.

These more typical groups are divided into two main sections or sub-orders, namely the even-toed

ungulates, or Artiodactyla, as typified by the ox, and an equivalent, albeit at the present day much smaller section, known as the odd-toed ungulates, or Perissodactyla, of which the horse and its relatives are the most specialised members. Although the leading points of distinction between these sub-orders have been indicated in my volume on the ox, it is advisable that the characteristics of the second should be repeated, as well as somewhat amplified, in this place.

The odd-toed, or perissodactyle, ungulates take their name from the circumstance that the toe corresponding to the middle finger of the human hand and its representative in the hind-limb, together with the bone known as metacarpal in the fore, and metatarsal in the hind leg, respectively form the continuation of the main axis of the limb, and are symmetrical in themselves. In the horse and its immediate relatives this middle toe is alone functionally developed in both the front and hind legs; but in the rhinoceroses, which belong to the same sub-order, although to a different family (*Rhinocerotidæ*), there is a pair of smaller lateral toes, each of which, together with its supporting metacarpal or metatarsal bone, is likewise symmetrical. Just as the middle toe of the fore-leg corresponds to the middle or third finger of the human hand, so the lateral toes of the rhinoceros severally represent the second and fourth fingers

of man; a similar correspondence to the toes of the human foot obtaining, of course, in the hind-leg. A practically identical correspondence obtains in the hind-foot of the tapirs, which belong to the third



The bones of the lower part of the left fore-leg of a Horse (A) and a Rhinoceros (B). *r*, lower end of radius or inner leg-bone; *u*, do. of ulna or outer leg-bone; *c*, carpus or wrist; *mc*, metacarpal bones; *ph*, phalanges or toe-bones; II., III., IV., second, third, and fourth toes, or (in A) the remnants of the metacarpals. In the horse *mc* is known as the cannon-bone, the two upper phalanges are termed pastern-bones, and the lower one is the coffin-bone.

and last family (*Tapiridæ*) of living perissodactyles. The front-foot of the tapir has, however, four toes, of which the outermost represents the fifth, or little, finger of the human hand. The addition, or rather

the retention, of the outermost toe does not, however, affect the symmetry of the other three front-toes of the tapir, which are arranged in just the same manner as in the three-toed fore-foot of a rhinoceros.

As a whole, however, the skeleton of the fore-foot of a tapir is obviously unsymmetrical, this being due to the loss of the toe corresponding to the human thumb, or first finger, as it should properly be called. And it may be noted here that this first toe has disappeared from both feet in all members of the odd-toed group, extinct as well as living, although it is developed in certain primitive members of the ungulate order, of which mention is made in the sequel.

This symmetrical development of the third toe (inclusive of the supporting metacarpal in the fore and the metatarsal in the hind limb) and its superiority in size over either of the lateral ones, when these are present, is the one great feature of the skeleton by which the odd-toed ungulates, or Perissodactyla, are distinguished from the even-toed group, or Artiodactyla. In the latter group, as is fully described in the volume on the ox, the third and fourth toes are equal in size, and developed symmetrically to one another on either side of the vertical line between them. Consequently, in that group the continuation of the main axis of the limb is formed by the vertical line

dividing the third from the fourth toe, whereas in the odd-toed group it is constituted by a line running down the middle of the third toe.

This, although by far the most important, is, however, by no means the sole character in which the skeleton of an odd-toed differs from that of an even-toed ungulate. One of the most easily recognised of these minor skeletal differences is the presence in the members of the odd-toed group of a more or less strongly marked projection or process on the outer side of the upper end of the shaft of the femur, or thigh-bone, which is totally absent in the even-toed group. Another, although less obvious, difference is to be found in the shape of the astragalus, or huckle-bone, of the tarsus, or ankle-joint—the so-called hock of the horse. In the Perissodactyla the lower surface of this bone is markedly flattened, whereas in the Artiodactyla the same surface is rounded and pulley-like : the vertical diameter of the whole bone being also relatively less in the former than in the latter group. Yet another difference is to be found in the number of joints, or vertebræ, in the backbone, or vertebral column, of the two groups. In perissodactyles the number of vertebræ between the skull and what is known as the sacrum (that is to say, the consolidated mass of vertebræ to which the haunch-bone, or pelvis, is attached) is never less than 29 and is very generally 30, whereas in the artiodactyles

it is invariably 26. If we exclude from this enumeration the seven cervical vertebræ common to all ungulates, this may be expressed in another way by saying that whereas in the odd-toed group the number of trunk-vertebræ may be 22 or 23, in the even-toed group it is invariably 19.

Other differences in the skeleton, as well as certain peculiarities in the teeth of the two groups, need not be mentioned here; but it may be observed that no perissodactyle has the complex type of stomach characteristic of the ruminating artiodactyles.

Although, as already mentioned, the Perissodactyla are represented at the present day only by three families — the *Equidæ*, *Rhinocerotidæ*, and *Tapiridæ*—the living members of each of which may be included in a single genus, during the Tertiary period they comprised several extinct families and a large number of genera. Nor is this all, for whereas, with the exception of the tapirs, which are common to Malaya and Tropical America, the group is nowadays restricted to the Old World, in past times it was abundantly represented in the New World, where the three existing families (together with certain extinct ones) occurred in North America, while the *Equidæ* succeeded in effecting an entrance during the latter part of the Tertiary period into South America.

Even this, however, does not represent the real

poverty of the odd-toed group at the present day, for the three surviving families are remarkable for the small number of their existing representatives. The horse tribe, for instance, includes at the present day only about eight or nine species, while the rhinoceroses comprise five, and the tapirs another five, or possibly six, specific types. The whole number of living perissodactyles is thus well under a score.

In this poverty of families, genera, and species the Perissodactyla present a remarkable contrast to the Artiodactyla of the existing epoch, whose specific representatives are between one and two hundred in number, and are classed in no less than nine or ten separate families, with a collectively world-wide distribution—exclusive, of course, of Australia. Despite the fact of its having lost a large number of generic and family types, the Artiodactyla may be regarded as a dominant type at the present day, whereas the Perissodactyla are as distinctly a waning group, so far, at least, as the numerical abundance of genera and species is concerned. What may have been the cause of this difference in the two groups cannot yet be determined.

As regards the characters by which the family *Equidæ* is distinguished from other groups of odd-toed ungulates, there is no difficulty at all when the existing representatives of the sub-order are alone taken into consideration, since the horse and

its immediate living relatives are broadly distinguished from all other modern mammals by the reduction of the number of toes on each foot to one. During the later part of the Tertiary, or latest, period of geological history there existed, however, a number of animals agreeing in all essential characters with the modern horse and its relatives, but with three toes to each foot, although the lateral ones were so small as to be of no functional importance. These three-toed horses, of which there is more than one generic type, had tall-crowned cheek-teeth differing from those of the modern horse only in certain comparatively unimportant details of structure, and in the somewhat inferior height of their crowns. Somewhat earlier in the Tertiary are found remains of other three-toed horse-like animals, which differ much more markedly from the modern type. Among their more salient differences are the relatively larger size of the lateral toes, which, in some cases at any rate, were at least partially of functional use; and, more important still, the quite short crowns of their cheek-teeth.

Now in defining the *Equidæ* it is found convenient to take tallness of crown in the cheek-teeth as the main distinctive character, and to include in that family only those species in which this feature is distinctly developed. The short-crowned species are accordingly referred to separate

families, of which all the members are extinct: to these fuller reference is made in the chapter on the extinct relatives of the horse. It will of course be obvious that if we had before us the whole of the ancestral series of the horse, we should find an absolutely complete gradation from types with tall-crowned to those with short-crowned cheek-teeth; and it would consequently be impossible to draw a hard-and-fast line between the two. In that case it would be necessary to make an arbitrary line of division, as it is sufficiently obvious that it is quite impossible to include all the ancestors of a given mammal in a single family group; as, if this were attempted, we should find reptiles included in the horse family, mammals being undoubtedly descended from certain extinct, and to some extent primitive, groups of reptiles.

The horse family, or *Equidæ*, may, then, be briefly defined as including such odd-toed or perissodactyle ungulates as have tall-crowned cheek-teeth of a peculiar and characteristic pattern (described later on), and each foot terminating in a single large functional toe, which, in the case of some extinct species, may be flanked by a pair of much smaller functionless toes. In the course of this chapter other characters are noticed which may likewise be used in the definition of the family, although the two mentioned above are amply sufficient for the purpose.

All the members, whether living or extinct, of the family, as thus restricted, come under the denomination of what naturalists term highly specialised animals; the specialisation in this instance taking the form of adaptation for the attainment of great speed in running, and likewise for grazing on grass or other herbage.

Their specialisation is best observed in the skeleton and teeth; the former departing almost as widely as possible from that of a generalised animal, such, so far as the structure of the limbs is concerned, as a bear.

In the latter animal each foot terminates in five complete and functional toes, usually armed with claws; and in walking the entire sole of the foot, inclusive of the heel-bone, or calcaneum, in the hind-pair, is applied to the ground.

In the horse and its existing relatives, together with certain extinct species, such as the one of which the skeleton is shown in plate xxiii., each foot terminates in a single toe (encased during life in a hoof), upon which alone the animal walks; this single toe, as already mentioned, and as shown in the figure on page 6, corresponding to the middle or third one of the generalised five-toed type. Consequently the heel, or ankle, technically known as the tarsus, in place of resting on the ground, as in the bear, is raised

high above it—forming, in fact, in the horse the so-called hock. Similarly in the fore-limb the wrist-joint, or carpus, is raised to the same approximate level above the ground, and constitutes the so-called knee of the horse.

The single metacarpal bone (*mc* in the figure on page 6) in the fore-leg of the horse is known as the cannon-bone; the same name being also applied to the corresponding element in the hind-leg, that is to say, the metatarsal bone. The remnants of the lateral metacarpals (II., IV. in the figure last cited) in the fore-leg, as well as those of the corresponding metatarsals in the hind-limb, are designated splint-bones. The degree of development, or rather of the degeneration, of these splint-bones varies considerably in different horses. In many instances, as in the figure on page 6, these bones represent merely the upper ends of the metacarpals and metatarsals. In other cases, as in the illustration of this part of the limb of a shire horse (pl. i. fig. 1) the whole shafts of the splint-bones are retained, with remnants at the lower end of the first and second toe-bones, or phalanges (1, 2). This comparatively full development of the splint-bones appears to be not uncommon in shire horses; but remnants of the toe-bones, which in all cases are firmly welded with the splint-bones, are retained in the skeleton of the famous racehorse "Stockwell," of which the

PLATE I

FIG. 1

FIG. 2

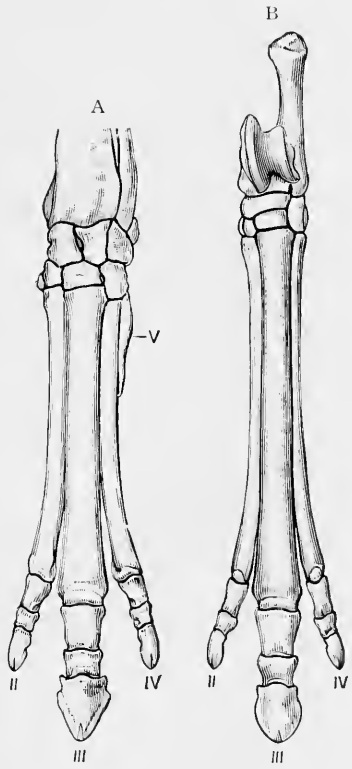


FIG. 1. Back view of fore (A) and hind (B) cannon and splint bones of Shire Horse.
FIG. 2. Front view of the bones of the left fore (A) and hind (B) feet of the extinct Three-toed American *Miohippus anceps*. ($\frac{1}{3}$ natural size.)

limb-bones are exhibited in the Natural History branch of the British Museum.

The figure of the bones of the feet of an extinct three-toed horse is placed alongside that of the cannon-bones of the shire horse in order to show how the splint-bones and rudimentary toe-bones of the latter correspond with the same bones in a more fully developed condition in the former.

So far as can be ascertained, the splint-bones of the horse and its existing relatives are of no use to their owners, although there is just a possibility that they may be of some slight service in mitigating shock. On the other hand, in domesticated horses they are frequently harmful, since, through inflammation and subsequent exostosis, they give rise to the disease known as splint.

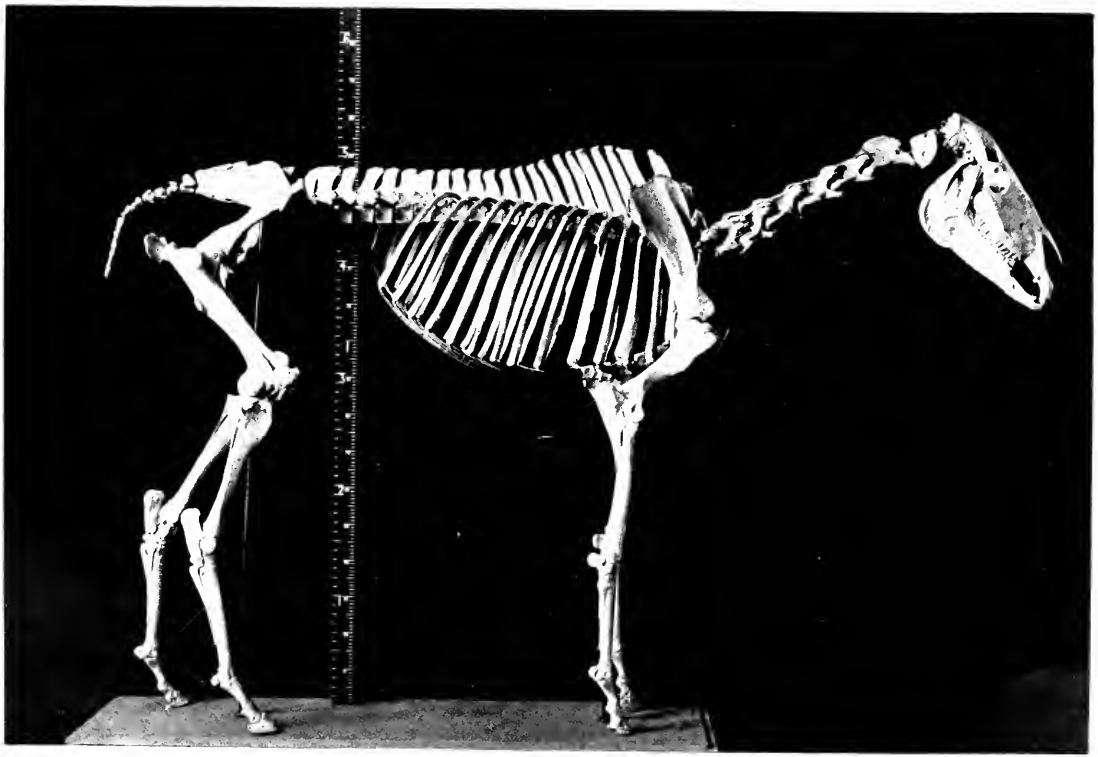
In this connection it is interesting to note that a few years ago Professor La Van de Pas, of the Agricultural and Veterinary Institute of Buenos Aires, published an account[1] of a prevalent type of degeneration in the splint-bones of Argentine horses. In 1904 the author received the left hind cannon-bone of a horse in which the outer splint-bone was only half the normal length, its lower portion being replaced by ligamentous tissue. The other cannon-bones of this horse were not forthcoming, but in the course of the next few years the author had the opportunity of examining a

[1] *Anales de Mus. Nacional de Buenos Aires*, ser. 3, vol. x.

considerable series of such bones. In a large proportion of these a similar degeneration was observed, sometimes in one and sometimes in both splint-bones ; and it may accordingly be considered that such atrophy is comparatively common in Argentine horses. It is further noticeable that the degeneration is more marked in the outer than in the inner splint-bone, alike in the fore and the hind limb. At the close of the descriptive portion of the communication the author arrives at the conclusion that Argentine horses are endeavouring to discard these seemingly useless portions of the skeleton.

It may be added that in veterinary anatomy the first and second phalanges, or toe-bones, of the horse's foot are respectively termed the upper and lower pastern-bones, while the enlarged terminal bone which carries the hoof is known as the coffin-bone. The last-named bone, it may be noted, is much wider in the fore-foot than in the hind-foot ; having almost the shape of a cheese-cutter in the fore-leg. Another term employed in veterinary works is fetlock, which denotes the joint between the lower end of the cannon-bone and the upper pastern.

The middle segment of the skeleton of the horse's fore-leg, that is to say the one immediately above the carpus, or so-called knee, is formed mainly by the radius, or inner leg-bone ; the ulna



Skeleton of Thoroughbred Stallion "Eclipse."

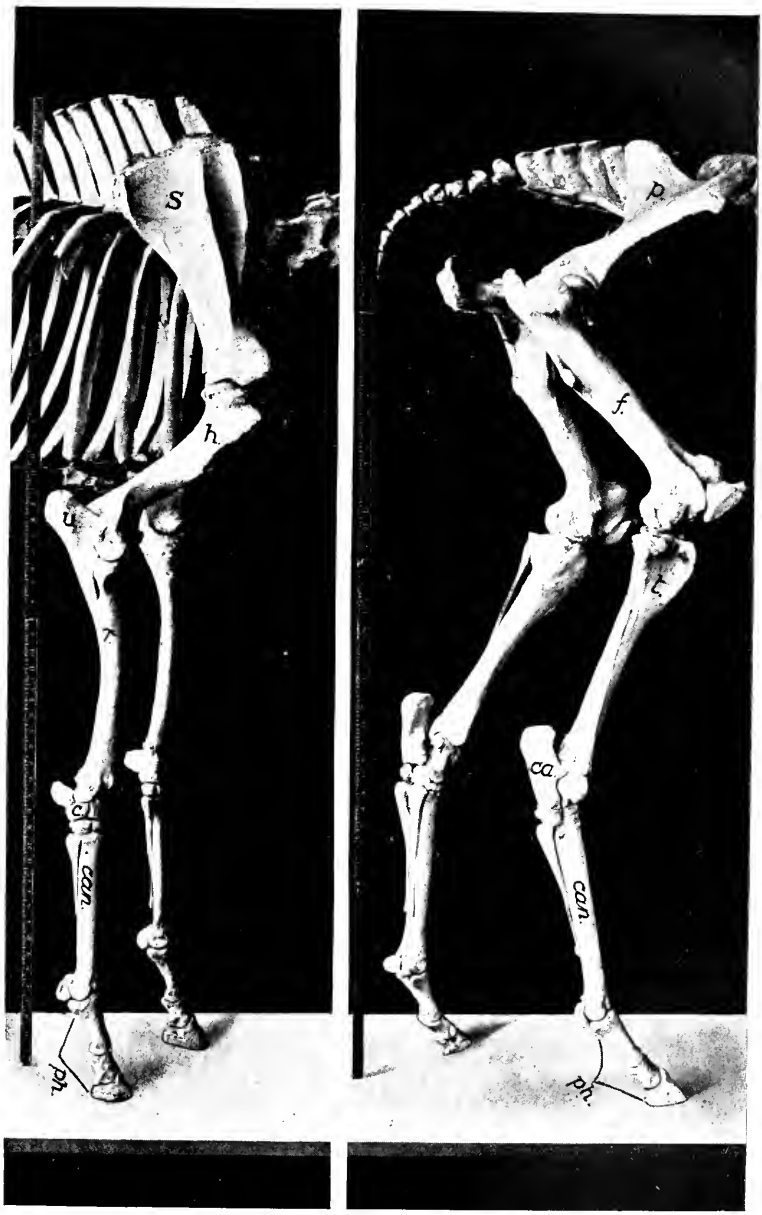
or outer leg-bone—which is as long as, and separate from the radius in less specialised animals, such as rhinoceroses—being represented only by its upper end, corresponding to the human elbow, or olecranon, and this being immovably soldered to the radius. In consequence of this welding of two originally separate bones into a single compound element, the fore-leg of a horse is capable of no other movement than a backwards and forwards one; this being all that is needed by a running animal. A similar consolidation and simplification of elements likewise obtains in the middle segment of the hind-leg of the horse, in which the originally distinct smaller bone known as the fibula is reduced to its upper extremity, this being firmly welded to the upper end of the larger bone, or tibia.

The reduction in the number of toes to a single large one in each foot, and of the metacarpal and metatarsal bones to the aforesaid splints, coupled with the elongation of the bones of the whole lower segment of the limb, the simplification and consolidation of those of the middle segment, and the raising of the carpus ("knee") and tarsus (hock) far above the level of the ground, so as to cause the animal to walk on the tips of its single toes, are the chief features in which the skeleton of the horse shows (as compared with that of more generalised animals) special adaptation for the attainment of a

high speed. Such a type of limb is the one evidently best suited to this end, since if the short, many-toed, and many-boned limb had been elongated without special modification to the extent of that of the horse, it is perfectly certain that it would have been unequal to the strain of carrying the body of such a heavy animal at a high rate of speed over hard ground.

In their limb-specialisation the horse and its relatives have attained practically the same evolutionary platform as the ruminant ungulates, only by a different line of development. In the horse group, as we have just seen, the development of a long cannon-bone in the lower segment of each limb has been brought about by the lengthening and strengthening of the middle element of the primitive five-toed foot. In the ruminants, on the other hand, the same end has been attained by the lengthening and fusion of two adjacent elements, so as to form a compound, in place of a simple, cannon-bone. At the present day the members of the horse family are absolutely unique in the matter of limb-structure, no other living mammal (or, for that matter, no other living animal) having a single-toed, or monodactyle, foot. It is, however, not a little remarkable that during the middle, or Miocene, portion of the Tertiary period South America was the home of a genus of hoofed mammals known as *Thoatherium*, in which a monodactyle type of foot had likewise

FIG. 1 FIG. 2



Skeleton of front (Fig. 1) and hind (Fig. 2) limbs of "Eclipse." *s*, scapula; *h*, humerus; *u*, ulna; *r*, radius; *c*, carpus or wrist ("knee"); *can*, cannon-bone; *ph*, phalanges or toe-bones; *p*, pelvis; *f*, femur; *t*, tibia; *ca*, calcaneum or upper bone of tarsus or ankle ("hock").

been developed by the reduction of the lateral toes of a nearly allied tridactyle relative. In this case the specialisation was even greater than in the horse group, as the splint-bones were reduced to mere nodules of bone on either side of each cannon-bone.

If *Thoatherium* had been a near relative of the horse, there would be no cause for surprise in its having attained the same remarkable and final stage of foot-development. As a matter of fact, it belongs, however, to a totally different and much more primitive group of ungulates, which appears to have been always restricted to South America, and although presenting certain structural resemblances to the Perissodactyla, is in other respects so distinct that it is ranked, under the name of Litopterna, as an equivalent subordinal group of the great order Ungulata. The most remarkable thing connected with *Thoatherium* is that, despite the specialised toes, its carpus and tarsus are of an exceedingly primitive type.[1]

Several noteworthy features occur in the skull of the horse and its existing relatives. In the first place, it differs from the skulls of all other living perissodactyles—namely, tapirs and rhinoceroses—in the complete closure of the rim of the socket of the eye by means of a bridge of bone extending

[1] See W. B. Scott, "The Litopterna," *Rep. Princeton Univ. Exped. to Patagonia*, vol. vii. pt. i. 1910.

from the forehead downwards to the horizontal bar known as the temporal arch. Secondly, it is characterised by the inordinate length of the portion in front of the socket of the eye, or orbit, as compared with the part behind the same. "In the horse," writes Professor H. F. Osborn,[1] "long-headedness is a very ancient character; even the earliest known four-toed horses have quite elongate, or at least mesaticephalic [moderately long] skulls.

Skull of a giant extinct Pig-like animal (*Elotherium*), to show the horse-like elongation of the facial portion.

The progressive elongation of the skull in horses is apparently for two purposes: first, to facilitate reaching the ground with the row of incisor or cropping teeth; second, and no less important, to allow space in front of the eye-sockets for the great rows of elongate, or hypsodont, grinding teeth, the marvellous dental battery of the horse. We might assume from these facts that long-headedness is correlated with long teeth, but the giant pigs

[1] *The Age of Mammals*, New York, 1910, p. 18.

(elotheres) have still longer and narrower skulls than the horse, yet all the teeth are brachyodont, or short-crowned. Again, the elephant has extremely elongate, or hypsodont, molar teeth, yet it also possesses the shortest skull known among the Mammalia."

Another feature in the skull of the existing members of the horse family is the comparative shortness of the slit separating the front end of the nasal bones, which form the roof of the nose-chamber, from those of the upper jaw, as is well shown in the figure of the skull of a shire horse (pl. iv. fig. 1). The importance of this feature will be apparent when the extinct relatives of the horse are taken into consideration in a later chapter.

Much has been made of the degree to which the facial portion of the skull of the horse is inclined to the basal axis of its hind part.[1] Although there is undoubtedly great variation in this respect between different horse-skulls, it is far from certain that they are really of any special importance. For it has been suggested that this bending down of the fore-part of the skull on the basal axis, which occurs in many grass-eating mammals, is primarily due to the "pull" or strain caused by the act of grazing; and if this be really the case, it is obvious that

[1] See J. C. Ewart, *Trans. R. Soc. Edinburgh*, vol. xlv. pp. 555, 587, 1907.

horses whose ancestors have for many generations been accustomed to feed on hard and tough grasses will show a greater degree of cranial deflection than those whose food has consisted either of softer and more easily yielding herbage or of grain. Moreover, it seems highly probable that the degree of deflection may vary with age—the older the animal, the greater the degree of bending. This, indeed, is exemplified in the case of two skulls figured by Professor Ewart on plate ii. of the memoir cited in the footnote to illustrate this feature; the one shown in the upper figure of that plate, in which the deflection is slight, being obviously that of a young animal, while the one in the lower figure, which displays the bending in a very marked degree, is as clearly that of an aged horse.

Yet another cranial feature remains to be noticed. In the skulls of certain domesticated horses, especially Arabs, thoroughbreds, and shires, a more or less distinct oval or circular depression may be noticed a short distance in front of the socket of the eye, or orbit, and therefore conveniently called the preorbital depression. It is shown faintly in the figure of the skull of a shire horse in plate iv. fig. 1, and more clearly in the photograph of the skull of a quagga (plate iv. fig. 2); the latter instance shows that the feature is not confined to the horse itself. Of itself, this feature may seem

FIG. 1

FIG. 2

FIG. 1. Skull of a Shire Stallion ; *pf*, preorbital depression.
FIG. 2. Skull of a Quagga, to show preorbital depression.

a very trivial one, but it happens, as will be noticed more fully in the sequel, that the skulls of certain extinct horses show a much more marked depression in the same region—a hollow so deep that it deserves the name of pit rather than depression.

Writing of this preorbital hollow in the extinct three-toed *Hipparion*, Sir W. H. Flower in his volume on *The Horse*,[1] observed that "although such a pit is not found in any of the existing species of horse, it was not infrequent in many extinct forms, and varied in them in size and depth. It so closely resembles a similar depression found in the same situation in many species of deer and antelopes, which lodges a glandular infolding or pouch of the skin called the 'suborbital gland,' 'crumen,' or in French 'larmier,' that there can be little doubt but that it had the same purpose in the hipparion. This gland in the existing animals that possess it secretes a peculiar oily odorous substance, the scent of which enables the animals provided with it to recognise each other even at immense distances, the faculty of smell being also developed to a wonderful degree. . . .

"The presence of this gland in the hipparion and its absence in the more modern *Equidæ* has been given as a reason for supposing that the latter are not the direct descendants of the former,

[1] London, 1891, p. 64.

but must have been derived from some other form in which such a specialisation had been developed. This, of course, is probable; but it must not be forgotten that very slight changes in habits, or the increased uses of other senses than that of smell, may have diminished the value of the information afforded by this gland, and ultimately led to the elimination of the organ itself. It may be that a change from a life habitually passed in forests or scrub to one in open plains would be sufficient to account for such a modification in structure."

Sir William Flower appears never to have noticed the presence of the slight preorbital depression in the skull of certain existing representatives of the horse family; but when it first came under my own observation the suggestion naturally arose that it was the last vestige of the decadent fore-gland of the three-toed hipparion.

Confirmation of this was afforded by a statement made by Professor T. H. Huxley,[1] that traces of a preorbital pit remain in the skulls of some of the fossil horses from the Siwalik Hills of Northern India. But this was not all, for some years ago I received a communication from a correspondent to the effect that he had seen a living horse, believed to be of Argentine origin, in which there was a distinct depression, although without any external orifice, just in front of each orbit. More

[1] *Quart. Journ. Geol. Soc.*, London, vol. xxvi. p. 2, 1870.

important still was a letter from Mr. Wilfred Scawen Blunt, the well-known possessor of a stud of Arabs, in which it was stated that he once owned a horse of this breed in which there was a well-developed and functional gland on one side of the face in the same position as the larmier of a deer. The identification of the preorbital depression in the skulls of certain existing members of the horse family has been accepted by Sir E. Ray Lankester,[1] who remarked that although dissection had not revealed any existence of glandular tissue in the structures overlying this structure in horses of Arab descent (in which the feature is very constant), yet it is not improbable that occasional instances of such survival will some day come to light.

On the other hand, Mr. R. I. Pocock,[2] after dissecting a number of horses' heads, came to a precisely opposite conclusion; remarking that he had failed to discover any trace of glandular tissue in the soft parts overlying the depression, and that the depression itself is very variable in its degree of development. He then adds that "from this hollow or from the corresponding area of the skull [when it is absent] arises a long muscle which passes forwards to supply the upper lip and nose; and I believe its sole significance is to give an increase of surface for muscular fibres. If this

[1] *Science from an Easy-Chair*, London, 1910, p. 87.
[2] *Ann. Mag. Nat. Hist.*, London, ser. 7, vol. xv., p. 517, 1905.

be so, variation in the extent to which the depression is developed is exactly what would be expected." Mr. Pocock then goes on to observe that the deeper pit observable in the skull of the extinct three-toed hipparion may possibly, although not probably, be also an area for muscular attachment. He adds that in the skull of the extinct South American *Onohippidium*, where the preorbital pit (as is shown in the concluding chapter of this volume) is very large, there appears to be a division into two parts, of which one is shallower than the other, and may correspond to the depression found in some existing members of the horse family.

Apparently, therefore, Mr. Pocock is of opinion that in the two extinct genera just mentioned lachrymal glands were probably developed.

A later writer, Professor Studer,[1] when describing a species of hipparion from the upper Tertiary strata of Samos, goes much further than this, and expresses the opinion that in no case is the preorbital pit for the reception of a lachrymal gland, but that it is always solely for the purpose of muscular attachment, and attains its maximum development in species like *Onohippidium* and the Samos species of *Hipparion* which were probably furnished with a proboscis. The position of the pit, it is stated, differs somewhat from that of a true larmier, and

[1] *Verh. Deutsch. Zool. Ges.* 1910–11, p. 11.

the inframaxillary foramen is always some distance from the pit.

Leaving the skull, attention may be directed to the teeth of the horse, which form an exceedingly important feature in its anatomy. As is well shown in the figure of the skull of a shire stallion in plate iv. fig. 1, there is a considerable gap between the front teeth, which are mainly adapted for nipping and biting, and the long series on each side of the face, which are conveniently called cheek-teeth, and whose function is to grind up the grass or other herbage gathered by the front teeth. In the anterior half of the aforesaid gap there occurs, however, in stallions a tusk on each side of both upper and lower jaws, which corresponds to the canine of carnivorous mammals, and is separated, in each jaw, from the three pairs of incisor teeth, which occupy the front of the jaws. In mares the tusks are either very small or wanting, from which it may be inferred that in stallions these teeth are mainly, if not entirely, used in fighting, and not for gathering or masticating food, for which, indeed, they are obviously unsuited.

The existence of this long gap between the front and the cheek teeth is a specialised feature; mammals of a more primitive type having either the whole of the teeth in contact, or with relatively small intervals on each side of the canines when these are large. A similar long gap occurs in the lower

dental series of the ox and its relatives, in which, however, the lower canines have become approximated to the incisors, with which they form a regular series of spatulate-crowned teeth. In the upper jaw of the ox tribe specialisation has been carried to a much greater extent than in the horse, the canines and incisors having completely disappeared, and being replaced by a hard pad which takes the bite of the lower front teeth. In consequence of the retention of upper as well as lower front teeth, a horse is apparently able to graze closer than an ox.

From the existence of the aforesaid long gap between the front and the cheek teeth in both the horse and the ox and their respective relatives, it would seem that such an arrangement is the one best suited for grazing or browsing animals; and it is not improbably for the purpose of affording room for the play of the large tongue, which takes an important share in the action of grazing.

The incisors of the horse, of which those of the lower jaw have somewhat less distinctly spatulate crowns than their representatives in the ox, present a relatively complex type, met with among no other living mammals outside the *Equidæ*. In place of having simple conical crowns when they first emerge in an unworn condition from the gum, the incisor teeth of the horse have a kind of pit, or pocket, at the summit, which penetrates far

down into the heart of the crown. The nature of this peculiar structure may be best understood by taking the finger of a kid glove, and, after filling it with soft wax, pushing in the summit by means of a fine pencil to a depth of an inch or so. This will give an exact representation of a horse's incisor, more especially if we smear the lower part of the outer surface of the finger with sealing-wax, as we shall then have representatives of the three constituents of the tooth. Thus the sealing-wax will represent the outer coat, or cement, the glove the middle element, or enamel, and the soft wax the inner constituent, technically known as the ivory or cement.

In this condition the wax-filled glove-finger with the pit, or "mark," at the tip, will represent the unworn incisor of the horse; but if we snip off with a pair of scissors half an inch from the summit, we shall have a model of the tooth after it has been in use for some time, and has had its tip ground away by wearing against its fellow in the opposite jaw. On looking at the section of the summit of the cut glove-finger, it will be seen that the original pit now forms an island in the middle of the soft wax (= dentine) bounded by a ring of kid (= enamel). By carrying the experiment one stage further, and cutting off another three-quarters of an inch from the summit, we shall have the model of an incisor of an old horse. In this state the pit, or "mark,"

will have completely disappeared; and the section will represent (1) a central core of soft wax, corresponding to the comparatively soft dentine, (2) a ring of kid, equivalent to the hard enamel, and (3) an irregular coat of sealing-wax, corresponding to the external layer of cement. A horse, like most mammals, grows two sets of incisor teeth in both jaws; firstly, a baby, or milk set, and secondly, a permanent set. The three teeth of the first set are, however, not all shed at once, but one by one, when they are as gradually replaced by their permanent successors, which grow up beneath. And it is by knowing how this replacement occurs, and noting the extent to which the central mark is worn away, that the age of a horse can be approximately ascertained up to six or seven years old. The "mark," it should be added, is common to both the temporary and the permanent set of incisors; but is deeper in those of the upper than in those of the lower jaw.

The jaws of a quite young colt show only the first and second pairs of milk-incisors, both above and below; but after a time the third pair appears on their outer sides. In a horse of about three years old the first pair of permanent incisors (recognisable by their larger size and unworn crowns) will have pushed out and replaced the corresponding baby-teeth. At an age of between three and a half and four years the second or middle pair of milk-incisors will have been similarly replaced by the permanent

pair. About half a year later the permanent tusks, or canines, make their appearance in the case of stallions. By the end of the fifth year the third or outermost pair of permanent incisors will have replaced the corresponding temporary pair; and the dentition of the front of the mouth will consequently be complete. It will be obvious that of the three pairs of upper permanent incisors, the crowns of the first pair will, after all are in place, be more worn than those of the second, and the second more than those of the third. As a rule, the mark disappears in the first pair of lower permanent incisors when the horse is six years old; in the second pair it is worn out a year later; and in the third pair at eight years. In the corresponding upper teeth it persists about two years longer in each instance. In the case of a six-years'-old horse the third lower incisors retain large and conspicuous marks. Up to five years the age of a horse can be determined with comparative accuracy, and it can also be approximately ascertained for some years later.

When the mark has been worn out in all the incisors, age-determination is no longer possible by means of the teeth. It appears, however, that in very old horses a kind of spurious mark is formed by the tooth becoming so worn down that the summit of the pulp-cavity at its base is exposed in the centre of the crown. Such a mark lacks, however, the ring of enamel characteristic of the true

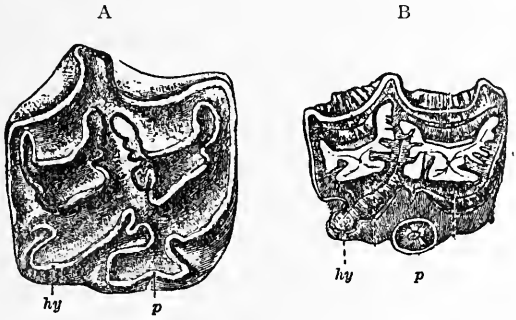
mark. Moreover, when this false mark makes its appearance, the section of the crown of the incisor has become much more triangular than in the early stages of wear; and in extreme old age, when the incisors are worn down to their very roots, these teeth become very narrow in the transverse direction, whereas in their earlier ages this diameter was considerably larger than the opposite one.

From the foregoing description, it will be evident that to the definition of the horse family given above may be added an additional characteristic, namely the presence in an early condition of wear, of a "mark," or pit, in the crowns of the incisor teeth. As regards the object of these pits, their function is probably to increase the grinding surface of the dentition as a whole during the period when the cheek-teeth have not attained their full development; the number of functional teeth of the latter series in young colts being only three pairs in each jaw, while at a later stage, when some at least of the permanent incisors have come into use, the hinder teeth of the cheek-series are not fully developed.

Before leaving this part of the subject, it may be mentioned as a remarkable circumstance that, in addition to the existing members of the horse family and some of their extinct forerunners, the only mammal which shows a pit in its incisors is

the South American extinct *Macrauchenia*, a member of the same sub-order (Litopterna) as *Thoatherium*, a genus already referred to in connection with the skeleton of the horse's foot. This shows that the *Equidæ* are paralleled in two remarkable structural features—by *Thoatherium* in the monodactyle feet, and by *Macrauchenia* in the presence of pits in the crowns of the incisor teeth.

Passing on to the cheek-teeth of the horse, it



A left upper molar of a Single-toed (*Equus*), A, and a Three-toed Horse (*Hipparion*), B. *p*, anterior pillar, *hy*, posterior pillar.

has to be noted in the first place that these are normally represented in the adult by six pairs in both the upper and lower jaw (pl. v.); of which the first three pairs, on account of being preceded by milk-teeth, are known as premolars, while the other three pairs, which have no such temporary predecessors, are the molars, or true molars, as they are often called. In some horses, however, there is a small and practically functionless tooth on the inner side of

the front end of the anterior premolar; and, more rarely, there may be a still smaller tooth in a corresponding position in the lower jaw. These small functionless teeth, which have no temporary predecessors, and are known to horse-dealers as "wolf-teeth," may be developed on only one side of the jaw. They are the vanishing representatives of teeth which were relatively large and functional in some of the extinct ancestors of the horse, and are of importance as showing that the three large functional premolars of the latter correspond to the three last of the typical mammalian series of four. Hence it is frequently found convenient to speak of these teeth as the second, third, and fourth premolars, instead of calling them the first, second, and third. On the other hand the three pairs of molars are respectively denominated the first, second, and third.

In a young colt, if the "wolf-teeth" be not developed, there are three pairs of milk-molars in each jaw; those of the upper jaw having their crowns more elongated from front to back than is the case with the premolars by which they are subsequently replaced. As the colt grows older, the first molar cuts the gum before the last premolar has replaced the corresponding milk-molar; and, as a consequence of this, it will always be found in an adult horse that the crown of the first molar is rather more worn than that of the tooth immediately in

FIG. 1

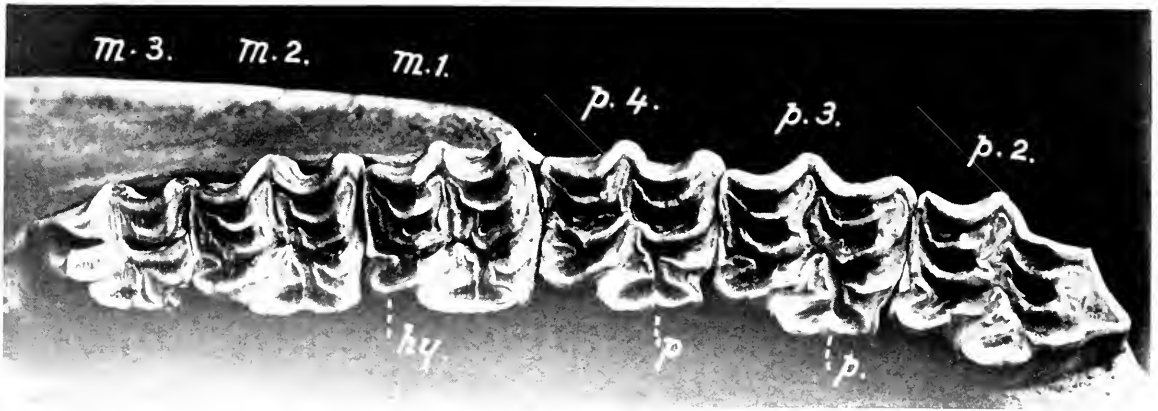


FIG. 2

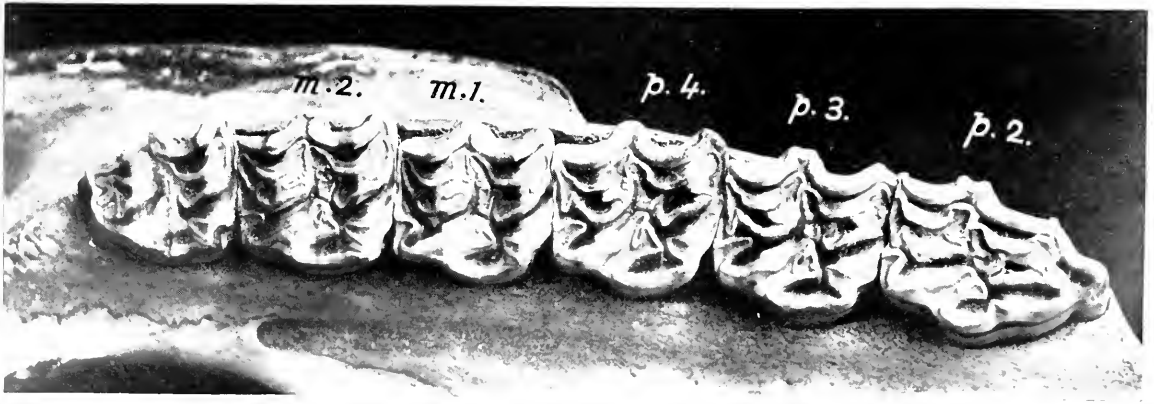


FIG. 1. The right upper cheek-teeth of the Tarpan or Wild Horse; *hy*, posterior pillar.
FIG. 2. The same teeth in an Arab Horse. *p.* 2, *p.* 3, *p.* 4, premolars; *m.* 1, *m.* 2, *m.* 3, molars; *p*, anterior pillar.

front of it, that is to say, the last premolar. With this exception, each cheek-tooth in an adult horse is always more worn than the tooth immediately behind it.

With the exception of the first and last, which are more or less pointed at the free end, an upper cheek-tooth of a horse consists of a square prism rather more than an inch in diameter, and about three inches in height when unworn, with its lower extremity terminating in four roots. Both the outer and inner surfaces are marked by strong vertical flutings; and when in use, only a small extent of the upper part of the crown is exposed above the gum.

As these teeth are usually seen in a more or less worn condition, it is preferable to take such a partially worn tooth as the basis for a description of their leading characteristics. Such a tooth may be compared in structure to the incisors; its apparent complexity of structure being due to the pushing-in, on the summit of the crown, of two pits comparable to the single pit, or "mark," in the incisor. These two pits are the two irregularly-shaped islands seen in the middle of the crown in A of the illustration on page 33. The centres of these pits, which extend right down to the base of the crown of the tooth, are filled with cement; and the walls of enamel with which they are lined are thrown into a number of more or less complex foldings.

These are most developed in the extinct three-toed hipparion, as shown in B of the same illustration, in which the cement filling the pits is white. Further complexity is produced by vertical flutings on the inner side of the crown, which result in the production of the two semi-isolated pillars marked *p* and *hy* in the aforesaid figures. Of these two inner pillars by far the more important from a systematic point of view is the front or anterior one (*p* in the illustrations), for it affords an important character in the definition of the genus *Equus*. In all the existing members of the horse family this pillar is connected by a narrow isthmus with the main body of the tooth; and the fore-and-aft diameter of its worn surface is considerably longer than the transverse one. A pillar of this type is termed a broad one; but there are certain extinct horses in which, while the pillar remains connected with the body of the tooth, its two diameters are nearly equal; in teeth of this type the anterior pillar is said to be narrow.

In the three-toed hipparions (B of the illustration on page 33) a totally different condition obtains, the anterior pillar, which is of the narrow type, being completely surrounded by a ring of enamel, so that its central core of dentine is cut off from the dentine of the main body of the tooth. To put the matter shortly, it may be said that while the upper molars of the horse and its immediate

relatives have the anterior pillar of a peninsular type, in the three-toed hipparions it assumes a completely insular form.

The lower cheek-teeth of the horse have much narrower crowns than the upper ones; but the foldings on their crowns are of the same general type, although in a reversed way, the portion corresponding to the inner pillars being on the outer side of the tooth. It will not be necessary to describe these teeth in detail.

In a general way the three upper molars of the horse correspond in structure with those of the ox. In each, as is best seen when the teeth are in an unworn condition, there is a pair of central pits or islands on the crown, around which are four sub-crescentic columns; but whereas the pits are almost completely filled with cement in the horse, in the ox they remain more or less open. Such a tooth may be described as consisting of two lateral lobes, each with a single central pit.

In the horse, as shown in the figures in plate v., the upper premolars are of the same structure as the molars; the last premolar being in some cases even larger than the first molar. In the ox, on the other hand, the upper premolars are smaller in size and simpler in structure than the molars; each of the former consisting of only a single lobe, with one central pit, although this lobe is somewhat larger than one of those of the

double-lobed ox-molars. In consequence of this greater complexity of its premolars (which is common to both upper and lower jaw), the dental mill of the horse, as Professor Osborn calls it, forms a more powerful and more efficient grinding instrument than that of the ox.

And the reason for this greater masticating power in the dentition of the horse is, I think, not very difficult to discover. As is stated in my volume on that animal, the ox, in common with other ruminants, gathers its food quickly, swallows it, and subsequently, owing to the complex structure of its stomach, regurgitates and remasticates it at leisure when in repose in a position of more or less security. The horse, on the other hand, who has a stomach of ordinary structure, has to completely masticate his food and swallow it once for all as soon as it is gathered, and this, too, in places where he may be exposed to attack from enemies. Consequently, it is of vital importance that the process of mastication should be accomplished not only in the most efficient manner, but likewise with the greatest possible rapidity. Hence the complexity and powerful grinding action of his cheek-teeth.

There is, however, another point in connection with these same cheek-teeth to which attention may now be directed. As already mentioned, these teeth are characterised by the great vertical height

of their crowns; in which respect, as will be shown in the sequel, they differ from the corresponding teeth of the horse's early ancestors, which had quite short crowns. Now, if surrounding conditions be the same, tall-crowned teeth indicate the potentiality of much longer life on the part of their owner than is afforded by low-crowned ones; as it is obvious that a tall tooth will take much longer to wear down than will a low one. In this particular instance it has, however, to be borne in mind that the early ancestors of the horse were swamp-dwelling animals living on soft, luscious vegetation which could be masticated without having much effect on their teeth. The horse and its relatives, on the other hand, when in a state of nature, live on open plains where the grass is often more or less hard and wiry, and thus calculated to wear away the teeth at a relatively rapid rate. In the case of domesticated horses the rate of wear is probably still further accelerated by the nature of the food.

Still, after making due allowance for all this, there can be little doubt that the existing members of the horse tribe are longer-lived animals than were their early forerunners. And, as animals go, the domesticated horse may be considered to have a considerable pre-eminence in the matter of longevity, although in this respect it does not equal its distant cousins the rhinoceroses, some of

which have been known to live for considerably more than half a century.

One of the oldest—if not actually the oldest—horses on record was an Australian, referred to in the *Field* newspaper of March 18, 1905. This horse is stated to have been foaled on November 16, 1860, and was still living at the date of the aforesaid notice, when he would have been rising 45. I never saw a notice of his death. The celebrated Godolphin Arabian, or Barb, who died in 1753, was brought from Paris 25 years previously, where he is reputed to have been drawing a water-cart: from this it may be inferred that he was well over 30 at the time of his death. His grandson "Matchem" is believed to have reached 33 years, while "Diomed," the winner of the first Derby, is reputed to have attained the age of 30 or 31. "Pocahontas," again, died in 1870 at the age of 33; while "Touchstone," who was foaled in 1831, died in 1861. Records of race-horses living to ages of between 23 and 27 years are comparatively common. Finally, it may be mentioned that the Duke of Bedford possesses the skull of a horse which, owing to infirmity, was shot when close upon 38 years of age. "Prince," as this animal was called, was one of the old small and sturdy Galloway cart-horse breed, now nearly extinct. He was foaled in Wigtownshire, and taken over at a valuation with an estate purchased by the Duke.

Although it does not come within the scope of the present volume to give a complete account of the structure of the horse, such as is to be found in the numerous works on veterinary anatomy, there are certain structural features, in addition to those already mentioned, which demand special notice on the ground of their morphological interest. The first of these is a wartlike structure buried in the tuft of long hair on the hind surface of each foot, which gives the name of fetlock (*i.e.* footlock or feet-lock) to this segment of the limb (pl. vi. fig. 1). When the tuft of hair is cut away, there will be revealed on the summit of a fatty cushion a bare patch covered with a warty growth to which French veterinarians have given the name of *ergot*, a word properly signifying the spur of a cock. The ergot is relatively larger in the ass than in the horse.

Sir William Flower[1] appears to have been the first to point out the true significance of the ergot, which really represents the large fatty pad or cushion on the sole of the foot of a dog situated above, and to a slight extent between, the four smaller toe-pads. Although now a rudimentary, or vestigial, structure, it was evidently functional in the early ancestors of the horse, which applied a considerable portion of the side of the foot to the ground, instead of resting only on the tip of the middle toe.

Although the term hoof is generally applied

[1] *The Horse*, Modern Science Series, London, 1891, p. 168.

to the whole of the terminal segment of the limb, it properly denotes—at all events, in an anatomical sense—only the dense horny shell or wall investing the front and lateral surfaces, and corresponding to the nail of the human middle finger or toe and the claw of the same toe in a dog. To the triangular, less hard, horny structure projecting from the back into the centre of the lower surface of the foot the name "frog" is applied.

In all members of the horse tribe the terminal segments of the fore and hind feet are remarkably alike; more alike, in fact, than in any other animals. In the horse itself this similarity is, however, somewhat less marked than in most of the other members of the group, the front hoofs being broader and rounder than the hind pair. In the kiang[1] of Tibet this difference is less marked, and in asses and zebras all the hoofs are relatively small and narrow, so that it is practically impossible to distinguish the front from the hind ones when separated from the rest of the limb.

In addition to the difference in the shape of the hoofs of the horse and kiang as compared with those of other members of the family, there are also specific differences in regard to the form of the frog. In the horse, for instance, the frog forms a long narrow ridge, deeply grooved posteriorly,

[1] The characteristics of this and other species mentioned in this chapter are given in the sequel.

which does not extend behind the extremities of the outer case of the hoof, and is not applied to the ground in walking. In the North African Grévy's zebra, on the other hand, the frog is broader, with scarcely any trace of the posterior groove, and its hind-part touches the ground when the animal is standing. In the kiang, and probably also in the Asiatic onagers, the posterior development of the hoof becomes much more marked, so that a considerable portion projects behind the case of the hoof and touches the ground, the cleft being deep and narrow. Still greater development of the hind part of the frog occurs in the ass, in which, as in some zebras, it also becomes much thickened and somewhat spongy in structure. In the extinct South American *Onohippidium*, the frog is somewhat intermediate between that of the horse and that of the ass, being grooved, and not projecting behind the case of the hoof, but being of considerable breadth and thickness. Finally, in the bontequagga, and probably the quagga, the medium-sized and slightly-cleft frog is deeply sunk in the hoof, behind which it projects to a small degree, not touching the ground, except when the hoof is much worn down.

These differences are probably correlated with differences in the nature of the habitat of the various species, and it is probable that species like the horse, in which the frog is narrow, are adapted for grassy or sandy plains; while those in which it is

broad, deep, and spongy, like the ass and the kiang, are better adapted for rocky ground. This is confirmed by the fact that the kiang does inhabit extremely stony and rocky country.

By far the most remarkable and interesting structures in the limbs of the horse are those commonly known as "chestnuts," although sometimes called "castors," but in old French veterinary works termed "sallenders" (from *salendre*) or "mallenders," from an idea that they were due to disease. In the fore-limb of the horse the chestnut (pl. vi. fig. 2) or callosity, takes the form of an elongated patch of bare warty skin situated some little distance above the knee, or carpus; while in the hind-limb there is a smaller patch—which may be absent in some cases—a short distance below the hock or tarsus, and likewise on the inner surface. In all the other members of the family the chestnuts are wanting in the hind-limbs; and in the ass and the zebras the front chestnut is larger, smoother, and softer than in the horse.

The question as to what structures in other mammals are represented by these chestnuts has been much discussed. Practically all naturalists are in accord in regarding them as vestigial structures; Sir W. H. Flower,[1] for instance, considering them to be decadent skin-glands. A qualified support to this theory is accorded by Mr. F. E.

[1] *The Horse*, p. 165.

PLATE VI

FIG 1

FIG. 2

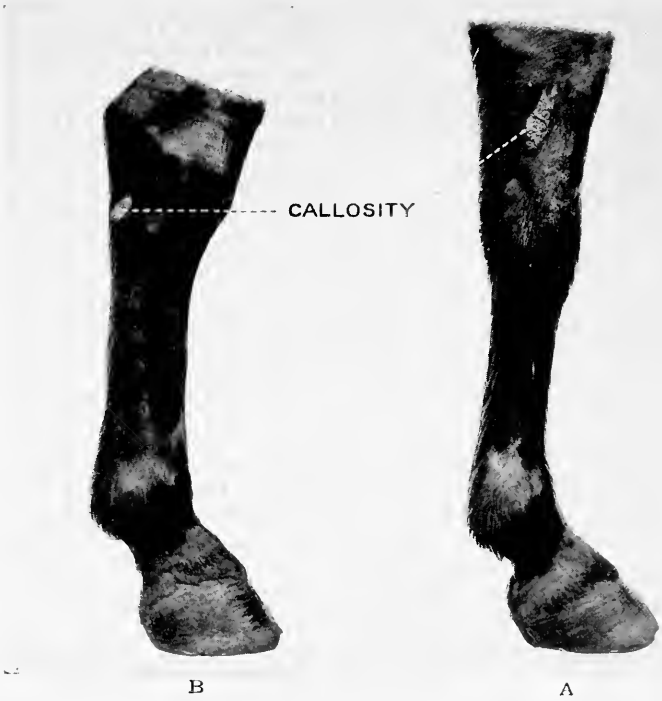


FIG. 1. Hind and lower surface of the foot of a Horse, showing the ergot.
FIG. 2. The chestnuts, or callosities, on the fore (A) and hind (B) legs of the Horse

Beddard,[1] who in one passage states that the chestnuts on the fore-limbs probably correspond to glands found in the neighbourhood of the wrist or carpus in certain other mammals, although on a subsequent page the glandular nature of these structures is questioned. In another and apparently later communication the same writer[2] suggested that the front chestnuts may represent a carpal sense-organ, of which remnants are believed to exist in the bristles on the wrists of the African hyraxes, the sole survivors of a formerly numerous group of ungulates. This degeneration of such a sense-organ might, it is suggested, result in the formation of a structure like a chestnut.

On the other hand, there exists an idea that the chestnuts represent vanished toes or foot-pads. This theory has been supported by Professor J. C. Ewart[3] of Edinburgh, and more recently by a German writer, Mr. R. Hintze,[4] who compares the hind chestnuts to the pads on the foot of a kangaroo.

If, however, the identification of the horse's ergot with the hind foot-pad of the tapir and the dog be admitted—and the evidence in its favour is very strong—it is practically certain that the chestnuts cannot represent foot-pads, much less

[1] *Cambridge Natural History—Mammalia*, pp. 12, 13, and 240.
[2] *Proc. Zool. Soc. London*, 1902, vol. i. p. 135.
[3] See *Nature*, London, vol. lvii. p. 239, 1903.
[4] *Zool. Anzeiger*, Leipzig, vol. xxv. pp. 372–382, 1910.

vanished toes. Pursuing this aspect of the subject still further, it should be borne in mind that, as I have pointed out in an article in the *Proceedings of the Zoological Society of London* for 1903, the chestnuts of the horse are situated on the inner surface, whereas, if they represented vestigial foot-pads, their position should be, *primâ facie*, on the hind aspect, as is the case with the ergot. It might, indeed, be argued that they have changed their original position, but of such a shifting there is no evidence in the adult horse. A second, and perhaps more important, objection to the foot-pad theory may be drawn from the fact that the chestnuts in the fore-limb are situated above the so-called knee-joint (carpus), and are therefore altogether higher up than any of the foot-pads of plantigrade mammals. Unless, therefore, another shift of position has taken place, the fore-chestnuts do not represent foot-pads. This argument was used by Sir W. H. Flower to disprove the theory that the chestnuts are remnants of lateral toes.

The hind-chestnuts, on the contrary, are situated a short distance below the joint of the hock (tarsus), and are therefore on a part of the limb, although on its inner side, which is included in the foot of a plantigrade mammal. If, however, the front-chestnut be regarded as corresponding in a general way with the hind one, it will be evident that in the

event of the former not being a foot-pad, the same will hold good for the latter.

A third, and perhaps stronger objection may be urged against the foot-pad theory. On the assumption that the chestnuts of the existing members of the *Equidæ* are vestiges of foot-pads, it is clear that these structures must have existed in the ancestors of that family since the time when such ancestors walked on the entire sole of the foot, in the plantigrade fashion; but, so far as I know, no ungulate was ever wholly plantigrade in both feet; the nearest approach to this condition obtaining in the Lower Eocene *Coryphodon*, in which the hind-limb was wholly plantigrade, while the front one was partially digitigrade. It has thus to be assumed, on the foot-pad hypothesis, that the front-chestnuts of the horse have been functionless structures from a period antedating the evolution of the Ungulata. Such a persistence, on exposed parts of the body, of a functionless structure seems improbable, especially when the modifications are borne in mind which, on this hypothesis, the horse-line must have undergone since the time when the chestnuts were functional structures. Perhaps the case of the ergot may be cited against this argument; but it should be remembered that this structure probably acted as a functional pad at a later stage of evolution than could have been the case with the chestnuts.

Having now stated some of the objections against identifying the horse's chestnuts with the foot-pads of polydactyle mammals, it remains to consider whether they can be identified with any other structures. Now a certain number of representatives of the deer family—notably the reindeer, the white-tailed deer, the mule-deer, and, in a rudimentary condition, the elk—are furnished on the inner side of the hock with a glandular tuft corresponding very closely in situation with the hind-chestnut of the horse. In fact, the only difference in the position of the two structures is that the tarsal tuft of the deer is placed rather lower on the hock. From the fact of its occurrence in deer so widely separated from one another as are the species mentioned, it seems evident that the tarsal gland (which is doubtless a scent-organ) is a very ancient structure, which was present in all the ancestors of the group, but has been lost, probably from disuse, in the great majority of Old World deer.

Judging from their position, there would seem to be a certain probability that the hind-chestnuts of the horse and the tarsal glands of the deer are corresponding structures.

With regard to the correspondence of the fore-chestnut of the horse, it may be mentioned that many gazelles have tufts of hair ("knee-brushes") at the knee (carpus), which are certainly glandular

in nature. And it is possible that these may represent the fore-chestnuts of the horse, for there seems no good reason why the position of a gland should not have somewhat shifted in two widely separated groups of mammals. Then, again, we have the carpal bristles of certain mammals, such as the South American coatis and the hyraxes, already referred to as the remnants of a "scent-organ"—a structure probably not far removed in its nature from a gland. The occurrence of these bristles in the hyraxes is very important. Mr. Beddard states that these are the only ungulates in which he has found these bristles. Carpal callosities are, however, described by Dr. W. Leche[1] as occurring in wart-hogs (*Phacochœrus*); although they are stated by their describer to be acquired, and not primitive structures. Of special importance is the occurrence of bristles in these structures, since, even if hairs be found to exist on the callosities of fœtal *Equidæ*, this would be no bar to the supposition of their glandular nature.

More recently, in the *Bulletin de la Société Scientifique et Medicale de l'Ouest* for July 1909, Veterinary Surgeon J. Roger directed attention to the presence on the inner and hind surface of the fore-legs of pigs, in proximity to the wrist or carpal joint, of a patch of large pores, which in certain circumstances exude a transparent and slightly

[1] *Biol. Centralblatt*, vol. xxii. p. 79, 1902.

glutinous fluid. After describing these sudoriparous glands in some detail, the writer suggested that they correspond to the chestnuts of the horse, or rather that the chestnuts represent the sudoriparous glands of the pigs in a decadent condition. The fact that those of the horse yield when cut a sticky, strong-smelling fluid favours this interpretation, which also accords fairly well with the theory that the chestnuts represent structures more or less similar to the foot-glands of deer.

As regards the structure of the chestnuts themselves, it may be noted that in the horse both pairs are of a distinctly warty nature, and that the hind pair is certainly in a more decadent condition than the other, being in fact on the verge of disappearing. In the zebras, on the other hand (in which the hind one has been lost), the fore-chestnut is larger and much less warty and also situated higher up. In dried skins it is, in fact, much more like the pale glandular patch of skin below the ear of a reedbuck. In this connection not only should Mr. Beddard's observations be borne in mind, but attention may be directed to others by Mr. Bland Sutton,[1] in which it is pointed out that in certain lemurs decadent glands are actually converted into bunches of spines, which are practically almost the same as warts; that is to say, they are excessive growths of somewhat abnormal dermal tissue. Hence there seems

[1] *Proc. Zool. Soc.*, 1887, p. 369.

no *primâ facie* reason why the chestnuts of the *Equidæ* should not be decadent glandular structures, the decadence being more marked in those of the horse than in the single pair of the asses and zebras.

There is, however, another point which may have an important bearing on the subject. As already mentioned, the presence of a depression in the skulls of certain extinct three-toed horses renders it probable that primitive horses were furnished with face-glands comparable to those of deer; such glands probably having a function somewhat analogous to that of the scent-glands on the limbs of the latter. If, then, the existing *Equidæ* have got rid of their face-glands, as being (perhaps on account of change of habit) useless, it is conceivable that, for the same reason, they may have also discarded their limb-glands.

And there is some reason to believe that such a change of habit has taken place during the evolution of the family. Mr. R. I. Pocock,[1] for instance, in a paper on the primitive colouring of the members of the horse tribe, to which fuller reference is made later, has suggested that the ancestral animals were inhabitants of forests, instead of open plains, remarking that this primitive type of colouring "would lend itself especially to concealment in horses accustomed to shelter in

[1] *Ann. Mag. Nat. Hist.*, London, ser. 8, vol. iv. p. 409, 1909.

woods through the foliage of which the sun-rays passed, dappling the leaves and tree-trunks with spots of light."

Now if such a change of habit has taken place, nothing would seem more likely than that it should have been accompanied by the loss of scent-glands, which would not be required among animals living in studs[1] on open plains in order to ascertain the whereabouts of their fellows.

There is, however, yet one more point in favour of the view that the chestnuts represent decadent scent-glands. As already mentioned, these structures exude, when cut, a strong-smelling fluid; and I am informed that this fluid will not only attract other horses, but that it was formerly employed by burglars and poachers to keep dogs quiet. If this be true, the fluid must almost certainly represent the secretion of an ancestral scent-gland.

Attention may now be directed to certain features connected with the colouring of the hair in the existing members of the horse family. It has long been noticed that dun-coloured domesticated horses frequently show a tendency to develop dark bars on the legs, and sometimes one or two transverse dark stripes across the shoulder and another along the middle line. And since similar markings occur

[1] Although the word "stud" is now used to denote a stable of horses, it originally denoted (Anglo-Saxon *stud*, Slav. *stôd*) a drove of wild horses, for which it is the proper term. See Heyn and Stallybrass, *Wanderings of Plants and Animals*, London, 1885, p. 39.

in the wild asses of Africa, while the zebras and quaggas of that country are marked by dark and light stripes over the whole or a considerable portion of the head, body, and limbs, it has been considered probable that all the ancestral members of the family were fully striped. Consequently species like the Mongolian wild horse, the Asiatic kiang, chigetai, and onager, and the North African wild ass, which are more or less nearly self-coloured, are presumed to have lost their stripes in accordance with the special conditions of their natural surroundings; and also that the tendency in dun horses, and it may be added mules, to the development of stripes is an instance of atavistic reversion.

In addition to this tendency to develop stripes on the limbs and shoulders in dun-coloured horses and mules, there is a still stronger tendency among domesticated horses of all colours except duns, but more especially greys, to show dappled markings. Attention was directed to this feature by Darwin,[1] who stated that it occasionally occurs among asses, and who expressed the opinion that it was probably connected in some way with the ancestral striping. At a much later date Dr. E. Bonavia, a brigade-surgeon in the Indian Medical Department, in a very remarkable book entitled *Studies in the Evolution of Animals*,[2] laid still greater stress on the frequent

[1] *Animals and Plants under Domestication*, 2nd ed. vol. i. p. 58, London, 1885.

[2] London, 1895.

occurrence of dappling in horses of all colours, and suggested that it must be a very deep-seated and ancient character of the group. He even went so far as to suggest that the dappling of the horse represents the rosettes on the leopard's skin, and that the latter are derived from the pattern on the bony plates of the armour of the extinct giant armadillos, or glyptodonts, of South America.

Now although this theory is certainly untenable it has the merit of recognising that dappling is a feature deeply implanted in the equine nature.

Giving full credit to the discoverer of this fact, Mr. R. I. Pocock,[1] who has done much to illustrate the meaning of animal coloration, has taken up the subject of the colours of domesticated horses, and concludes that their colouring may be classed under three main types. The first of these types comprises bays, blacks, chestnuts, roans, piebalds, and skewbalds; the second includes duns alone; while the third is represented by greys and the majority of whites. From the fact that in all wild members of the horse family the mane and tail are darker in colour than the body, it is inferred that bay is the original phase of the first type. On this phase three modifications have been working, namely, blackness, or melanism, to give rise to browns and blacks; redness, or erythrism, to produce chestnuts; and whiteness, or albinism, to develop (in

[1] *Ann. Mag. Nat. Hist.*, London, ser. 8, vol. iv. p. 404, 1909.

conjunction with melanism and erythrism) piebalds and skewbalds, and in another direction greys, and finally whites.

That this is not a mere fanciful suggestion is made evident by the fact that melanism, erythrism, and albinism are recognised features in the colour-development of wild animals. It is added that chestnuts, from the extension of the red to the mane and tail, may be regarded in the light of "sports."

It has been suggested by Professor W. Ridgeway, in his work *On the Origin of the Thoroughbred Horse*,[1] that the white forehead-star and white "stockings" so often observed in chestnut thoroughbreds are hereditary features derived from the ancestor of that breed; but this idea is rejected by Mr. Pocock, who shows that such markings are to be regarded as first steps in the direction of albinism, and are consequently in no sense ancestral.

Dappling, as already mentioned, may occur in horses of all colours, but is most common in bays and greys and rarest of all in duns; this prevalence being the main justification for Dr. Bonavia's view that it is an extremely ancient feature in the equine organisation. Mr. Pocock believes, indeed, that dappling is even older than striping, and he has also been led to conclude that the ancestral forms of the horse family were dark-coloured animals marked with white or yellowish flecks or spots arranged in

[1] Cambridge, 1905.

much the same manner as are those on the coats of young tapirs. A certain amount of support to this theory is afforded by the circumstance that it tends to bring two families of the odd-toed section of the hoofed mammals into line with one another in the matter of colouring.

These hypothetical white markings of the ancestral members of the horse tribe are presumed to have taken in the first instance the form of simple round spots, which subsequently tended to arrange themselves in lines and then to coalesce into longitudinal streaks, but finally underwent a rearrangement, so as to produce light transverse bars or stripes on the greater portion of the head and body. On this view, zebras should be regarded as black or brown animals with white or buff stripes, and not, after the ordinary fashion, as white ones with dark stripes; this idea having been suggested some years previous to the publication of Mr. Pocock's paper by Sir H. H. Johnston. Similarly, there appear to be good grounds for considering that giraffes were originally brown or red animals with vertical white stripes arranged like those of elands and their cousin the bongo antelope of the forests of Equatorial Africa.

It may be added that dappling occurs only in domesticated horses and occasionally in asses and mules, and that it is very rare in duns. From its absence in the wild Mongolian horse, which may

safely be regarded as the ancestor of many of the domesticated European breeds, it may be suggested that dappling is an attribute of the Arab stock, which, as will be shown later, there is considerable reason to regard as being derived from a species different to the one which gave rise to the original domesticated horses of Western Europe. It is quite true that there are difficulties in regard to this suggestion; one of them being that we have no information as to when Arab or Barb blood was first introduced among the horses of Western Europe, while we are equally in the dark as to whether dappling always occurred among the latter, or whether it is a foreign feature.

It does, however, appear very strange that if dappling be a remnant of an ancient type of colouring at one period characteristic of the horse tribe in general, it should have completely died out in all wild species, to reappear in the domesticated breeds of *Equus caballus*. And the only way out of the difficulty seems to be the above suggestion, that the progenitor of the Arab and Barb was a dappled bay horse.

As regards the inheritance of coat-colour among horses, it appears, according to Mr. R. Bunsow,[1] that in the case of thoroughbreds, bays (including browns) may be either pure as regards the power of transmitting their colour to their offspring, or

[1] *The Mendel Journal*, London, No. 2, p. 74, 1911.

impure, when they may give rise to chestnuts. It thus follows that bays, as being capable of producing offspring of a colour different to their own, are a dominant type (D), while chestnuts, which lack this capacity, are recessive (R). Chestnut horses, as having but one kind of sexual cells, may accordingly all be symbolised as RR, whereas bays may be classed either as DD or DR, according as to whether they are pure or whether they contain an admixture of chestnut cells. Now if a DD stallion be mated with an RR mare, all the foals will be DR bays. On the other hand, the foals of an RR mare by a DR stallion will, in the long run, consist of bays and chestnuts in nearly equal numbers. When chestnuts are bred together, their offspring should be all chestnuts (RR), but if chestnuts be crossed with bays, the foals may be either all bays or half chestnuts (RR) and half bays (DR), the former case, as mentioned above, being due to the fact that the parent bays were DD, and the latter to their being DR. Certain apparent exceptions to these conditions occurring in the Stud-book are shown to be due to incorrect registration of colour, and it is probable that the same is the case with all the rest. As regards greys, it is stated that in all cases one of the parents must be of this colour.

At the meeting of the British Association held at Portsmouth in 1911 Mr. C. C. Hurst discussed the question whether there is any connection

between the coat-colour and the speed of thoroughbreds. Although such a relationship appears to be generally lacking, evidence is gradually accumulating to suggest that in certain strains there may be a partial coupling of coat-colour and racing power. For instance, the chestnut grand-children of the famous thoroughbred "St. Simon" have so far proved themselves to be much inferior in racing power to their bay and brown brothers and sisters. While these chestnuts have between them won only two first-class races, their bay and brown brothers and sisters have between them won fifteen classic races, and are only about twice as numerous. Another interesting point under investigation was the apparent partial conjunction of brown coats, high racing power, and female sex in St. Simon's own offspring. St. Simon's brown fillies proved themselves to be strikingly superior in racing power to the bay fillies, the brown colts, and even the bay colts, a few individuals of which were extraordinarily good. This was the more remarkable when it is considered that in racing colts have many advantages over fillies. It seems possible that the elucidation of such an apparently trivial thing as coat-colour may help to throw light on the more complicated question of the breeding of a first-class winner.

Certain abnormalities in the structure of the skeleton of the horse occur from time to time, of which it will suffice to refer to three. The first of

these occurs in the bones of the foot, and takes the form of the more or less complete development of one or both of the lateral toes normally represented by the splint-bones. In certain instances, as has been pointed out by Sir William Flower, when only one of these lateral toes is developed, the abnormality does not apparently indicate reversion to an ancestral type, but seems due to a splitting of the bones of the main toe. In other cases, however, there seems little doubt that such supplemental toes are really a reversion to the condition obtaining in the extinct three-toed members of the family. An instance of this kind of reversion is exhibited in the foot of a shire colt formerly in the possession of Lord Wantage, by whom the specimen was presented to the British Museum. The metacarpal bones of the fore-foot are complete, although varying in size, and the terminal toe-bones carried complete hoofs.

Apparently this reversion to the three-toed type occurs only among domesticated horses.

A second abnormality among domesticated horses is displayed by the development of rudimentary horns, or rather horn-cores, on the forehead (pl. vii. fig. 1). In his *Animals and Plants under Domestication*,[1] Darwin wrote that "In various countries horn-like projections have been observed on the frontal bones of the horse: in

[1] Vol. i. p. 52.

FIG. 1

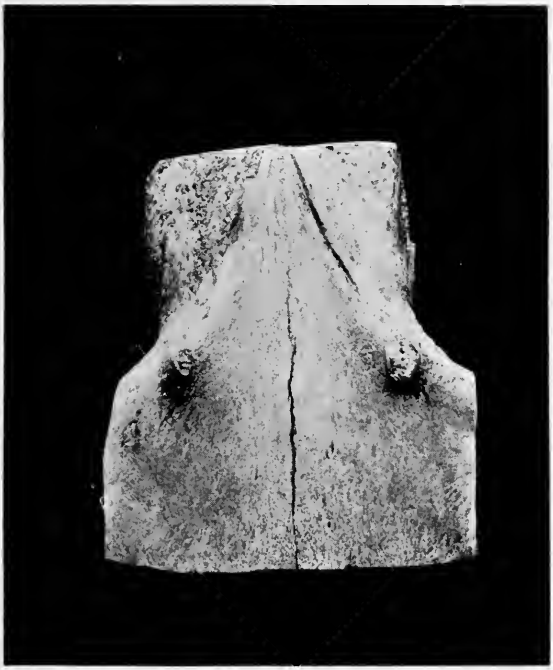


FIG. 2

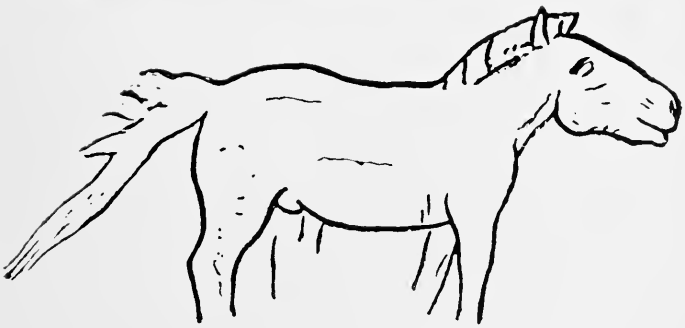


FIG. 1. Frontlet of Horse, showing horn-like processes.
FIG. 2. Outline of the Prehistoric Tarpan or Wild Horse, incised on a piece of horn, from the Madelaine Rock-shelter in the Department of Dordogne, France.

one case described by Mr. Percival[1] they arose about two inches above the orbital processes, and were very like those in a calf from five to six months old, being from half to three-quarters of an inch in length. Azara[2] has described two cases in South America in which the projections were between three and four inches in length: other instances have occurred in Spain."

The same abnormality is displayed in four specimens exhibited in the British Museum (Natural History). The first of these is the skull of an English horse presented by Mr. Hanbury Carlile; while of the three other specimens of the same type, one is the frontal region of the skull of an English horse showing the pair of rudimentary horns in precisely the same position as in the first specimen, but of somewhat larger size. The other two are models of the foreheads of thoroughbreds, each showing a pair of similar horns, situated as in the preceding specimens. These are important as showing that the skin extends uniformly over the horn-like processes, without any trace of a dermal horn; the same condition being observable in the other two examples. Baron Francis Nopcsa informs me that he knows of a horse in Transylvania with rudimentary horns. The significance of these horn-like growths is at present inexplicable, seeing

[1] *The Veterinary*, vol. i. p. 224.
[2] *Quadrupèdes du Paraguay*, vol. ii. p. 313, 1801.

that none of the ancestral horses, or even of the collateral branches of the horse-stock, were horned animals. Probably it is a kind of redundant development, such as occurs in the later types of many groups of animals; seeing that the members of the horse family have efficient fighting weapons in their hoofs, and that they are also largely protected from foes by their speed. It would be of great interest if it were possible to ascertain whether all these "horned horses" were of Arab or Barb descent.

One other abnormality, and this an individual one, may also be referred to. In the limb-bones of the celebrated thoroughbred "Stockwell" (1849–1876), which are exhibited in the British Museum (Natural History) the projection on the hind border of the femur, or thigh-bone, known as the third trochanter (*vide supra*, p. 8) is almost obsolete; and it would be interesting to ascertain if the same feature characterises the skeleton of his descendants, if any of these have been preserved. It seems natural to suppose that the practical absence of the trochanter would have had some effect on the action of Stockwell; and it is very noteworthy that in describing the sale of the Burghley Stud, a writer signing himself "The Druid" states in *Post and Paddock*, 1857, p. 296, that "Stockwell came ambling out in his peculiar style, with his Roman head and massive muscular points much

fined down since he all but broke Teddington's heart." This seems to suggest that the horse had a distinctive action of his own.

In this place a few lines may be devoted to the action and position of the limbs of a horse at the gallop, and the conventional modes of representing the same. In this action the movements of the limbs are so rapid that, like the spokes of a quickly revolving wheel, the relative positions of the limbs at any particular moment cannot be appreciated by the human eye. Instantaneous photography shows, however, that all the conventional modes of representing the galloping horse are untrue to nature.

Sir E. Ray Lankester in one of his articles published in the *Daily Telegraph* under the title of "Science from an Easy-Chair," has, for instance, pointed out "that what has been drawn by artists and called 'the flying gallop,' in which the legs are fully extended and all the feet are off the ground, with the hind-hoofs turned upwards, never occurs at all in the galloping horse, nor anything in the least like it. There is a fraction of a second when all four legs of the galloping horse are off the ground, but they are not then extended, but, on the contrary, are drawn, the hind ones forward, and the front ones backward, under the horse's belly. A model showing this actual instantaneous attitude of the galloping horse has been placed

in the Natural History Museum. When the hoofs touch the ground again after this instantaneous lifting and bending of the legs under the horse, the first to touch it is one of the hind-legs, which is pushed very far forward, forming an acute angle with the body. The shock of the horse's impact on the ground is thus received by the hind-leg which reaches obliquely forward beneath the body like an elastic spring. Since the instantaneous photographs have become generally known, artists have ceased to represent the galloping horse in the curious stretched pose which used to be familiar to every one in Herring's racing plates, with both fore- and hind-legs nearly horizontal, and the flat surface of the hind-hoofs actually turned upwards!"

Later on in the same article it is mentioned how M. Solomon Reinach has shown "that in Assyrian, Egyptian, Greek, Roman, mediæval, and modern art up to the end of the eighteenth century 'the flying gallop' does not appear at all. The first example (so far as those schools are concerned) is an engraving by G. T. Stubbs in 1794 of a horse called Baronet. The essential points about 'the flying gallop' are that the fore-limbs are fully stretched forward, the hind-limbs fully stretched backward, and that the flat surfaces of the hinder hoofs are facing upward. After this engraving of 1794 the attitude became generally adopted in English art to represent a galloping horse. . . . Reinach

has shown that in the pre-Homeric art of Greece—that which is called 'Mycenæan' (of which so much was made known by the discoveries of that wonderful man Schliemann when he dug up the citadel of Agamemnon)—the figures of animals, horses, deer, bulls (see the beautiful gold cups of Vaphio!), dogs, lions, and griffins, in the exact conventional pose of 'the flying gallop,' are quite abundant! There was an absolute break in the tradition of art between the early gold-workers of Mykené (1800 to 1000 B.C.) and the Greeks of Homer's time (800 B.C.). Europe never received it, nor did the Assyrians nor the Egyptians. Thirty centuries and more separate the reappearance in Europe of 'the flying gallop'—through Stubbs—from the only other European example of it—the Mycenæan. What, then, had become of it, and how did it come to England? M. Reinach shows by actual specimens of art-work that the Mycenæan art tradition, and with it 'the flying gallop,' passed slowly through Asia Minor into ancient Persia, thence by Southern Siberia to the Chinese Empire, as early as 150 B.C., and that 'the flying gallop,' so to speak, 'flourished' there for centuries, and was transmitted by the Chinese to the Japanese, in whose drawings it is frequent. It was at last finally brought back to Europe, and to the extreme west of it, namely, England, by the importation in the eighteenth century into England of large

numbers of Japanese works of art. M. Reinach thinks that 'the flying gallop' was devised as an intentional expression of energy in movement. I venture to hold the opinion that it was observed by the Mycenæans in the dog, in which Muybridge's photographs (now before me) demonstrate that it occurs regularly as an attitude of that animal's quickest pace or gallop. It is easy to see 'the flying gallop' in the case of the dog, since the dog does not travel so fast as the galloping horse, and can be more readily brought under accurate vision on account of its smaller size. It is quite in accordance with probability that the early Mycenæan artists, having seen how the dog gallops, erroneously proceeded to put the galloping horse and all other animals which they wished 'to make gallop' into the same position."

This chapter may be brought to a close by a few remarks in regard to the past and present geographical distribution of the horse family and a brief reference to certain Hindu myths and customs relating to the horse. At the present day the group, in a wild state, is restricted to the Old World, where it is widely distributed in Asia and Africa, while, as is shown in the next chapter, it existed at a comparatively recent date in Eastern Europe. In Asia it does not, however, extend farther east than Western India and Mongolia, or further north than the latter country and Tibet. The Asiatic

representatives of the group include the wild horse and the animals known as chigetais, kiangs, and onagers, which serve in some degree to connect the former with the ass. The latter, in a wild state, is restricted to North-eastern Africa; while the east and south of the African continent form the home of the striped members of the family, commonly known as zebras and quaggas.

During the Prehistoric Stone Ages, as is more fully indicated in later chapters, the range of some of the living Asiatic members of the group extended to Western Europe. At an earlier date (Pliocene and Pleistocene) extinct species of horses roamed over Central and Northern India. And at some period horses doubtless ranged right across Asia to Bering Strait, as remains of a species closely allied to the existing horse occur on the opposite side of the Strait in the frozen soil of Alaska.

Moreover, throughout the later portion of the Tertiary period numerous extinct representatives of the family inhabited North America, where horses or asses were quite unknown when that continent was discovered by Columbus. Nor is this all, for quite late in the Tertiary period, when South America, which had previously been isolated for a long epoch, became connected by land with North America, members of the family traversed the Isthmus of Darien, and made their way into Argentina and Patagonia, where they developed

into several altogether peculiar types. It is generally believed that at the time South America was explored by the Spanish conquistadores the native wild horses had become exterminated, although it has been suggested that certain horses seen by John Cabot in Argentina in 1530 were remnants of the indigenous stock, as it is difficult to see how introduced animals had reached that part of the country at such an early date.

As regards the birthplace of the family, it was suggested by a famous American naturalist, Professor E. D. Cope, that the horse tribe had two independent centres of development from animals of a more primitive type, one in the Old World, and a second in North America. On the face of it, this is, however, a very improbable theory, and a more plausible suggestion has been subsequently made by another American naturalist, Dr. W. D. Matthew,[1] who wrote as follows: "I assume that since the oreodonts [extinct American hog-like animals] and peccaries [the New World representatives of the swine] never reached the Old World, and the camels did not reach it till the Pliocene, their centres of dispersal were well to the south of the [ancient] Bering Sea connection with the Old World. I assume that since the horses are represented by a double evolutionary series, one in

[1] "The Continuity of Development," *Popular Science Monthly*, New York, 1910, p. 473.

Europe, a closer one in North America, their centre of dispersal lay far enough north to spread into Europe on the one hand, and North America on the other, but that the latter was nearer and more accessible; *i.e.* that centre of dispersal was North-eastern Asia or Alaska."

To deal adequately with the subject of the important part played by the horse in the development of civilisation would require as much space as is contained in the whole of the present volume; but it may be of interest to refer to certain Hindu myths relating to the origin of the horse, especially as these have a curious bearing on the classical fable of Pegasus, the flying horse.

In the introduction to an Indian work on the horse Colonel D. C. Phillott[1] writes on this subject as follows :—

"According to Hindu legends, the horse was created a winged animal, one that could fly and run, and no man or god could snare it. Indra wanted horses for his chariots, and requested the sage Salihotra to deprive the horses of their wings. Accordingly Salihotra, by *yoga*, a supernatural power, derived by his austerities, accomplished Indra's wish. The horses, now deprived of the ability to visit far-off jungles in search of medicinal herbs, approached Salihotra and entreated him to

[1] *The Faras-Nama-e Rangin, or the Book of the Horse*, London, 1911.

write a book on the treatment of their diseases. Salihotra consented, and composed the greatest work on veterinary science known to the Hindus. This work was called *Salihotra* after him; gradually this Sanskrit word came to mean veterinary science in general and also a horse. To-day every regiment of native cavalry has its *salotris*."

Later on the same author observes that "Besides its use in war, the horse was important in Hindu eyes as an animal of sacrifice. . . . In the Vedic period the sacrificial horse was first slain sacrificially (*i.e.* by severing the head at one blow), and then divided in portions, part being eaten by the attendant priests, and part being offered as a burnt-offering. In this age the object of the sacrifice was to obtain wealth, prosperity, and male offspring.

"The Puranas, written several hundred years after the Vedas, describe the *asvamedha* as a sacrifice of the highest order. Performed a hundred times, it elevated the sacrificer to the throne of *Svarga*, Indra's dominion, deposing even the king of the gods. . . .

"In the succeeding epic period, *i.e.* after 1200 B.C., this sacrifice was made by kings to demonstrate their claim to supremacy over neighbouring chiefs."

What, if any, connection there may be between these ancient Hindu sacrifices and the slaughter of horses at the obsequies of the old Scandinavian chieftains, must be left for others to determine.

CHAPTER II

THE WILD TARPAN AND ITS RELATIONS

Since the time of Cuvier it has been known that teeth and bones of horses are of common occurrence in the Prehistoric and other superficial formations of the continent of Europe and the British Isles, and consequently that wild horses inhabited this area contemporaneously with the mammoth, the woolly rhinoceros, and the men of the Stone Age. There is, moreover, abundant evidence to show that during that long-past age primitive man hunted these wild horses for the sake of their flesh; the long bones of the limbs being split for the purpose of extracting the marrow, while in some instances the brain-chamber of the skull has likewise been fractured and opened in order that the brain itself might be used for food. Nor is this all, for some of the men of the Stone Age have left in the caves which afforded them shelter from the weather crude but life-like outline sketches of the horses they hunted for food, and subsequently domesticated; these sketches serving to show that, in certain instances, at any rate, these Stone Age horses were closely allied to the existing tarpan,

or wild horse, of the Zungarian district of Mongolia, having big heads, but relatively slender limbs.

These Stone Age horses will be described later on in this chapter; and attention may now be directed to the evidence relating to the survival of wild horses in Western Europe during the historic period. In this connection it will be convenient to quote the summary of the evidence given by Messrs. Heyn and Stallybrass in their work entitled *The Wanderings of Plants and Animals*.[1] After pointing out that wild horses exist in Mongolia, the authors proceed as follows :—

"That the horse in its original wildness also roamed westward to Turkestan, over the steppes of the present South-eastern and Southern Russia, and to the foot of the Carpathians, seems likely enough; not so likely that even the forest regions of Central Europe once abounded in troops of that animal. And yet much historical testimony seems to put the fact beyond a doubt. Varro speaks of Spanish wild horses; and Strabo writes, 'In Iberia there are many deer and wild horses.' Wild horses as well as wild bulls lived among the Alps, as we learn again from Strabo; and Pliny tells us, not only in the Alps but in the north generally. Nor are the Middle Ages wanting in proofs of the existence of wild horses in Germany and the countries east of Germany. At the time of Venantius Fortunatus

[1] London, 1885, p. 37.

the *onager*—under which name may be understood the wild horse—was haunted in the Ardennes, as well as bears, stags, and wild boars. In Italy wild horses were seen for the first time during the rule of the Longobards, under King Agilulf.

"In 732 Pope Gregory III. writes to St. Boniface: 'Thou hast permitted to some the flesh of the wild horse, and to most that of the tame. Henceforward, holy brother, thou shalt in no wise allow it.' So, up to that time the Apostle of the Germans had been very liberal, perhaps because in his native island he had been accustomed from his youth to the habit which appeared so horrible to the Italian at Rome. Among the benedictions of Monk Ekkehard of St. Gallen (about A.D. 1000) to be pronounced over the meats to be served in the refectory of that monastery, one refers to the flesh of wild horses, which must therefore have been eaten by the pious brethren. An old German proverb says: 'A foal taken from a herd of wild horses will sooner be tamed than a depraved man learn to be ashamed.' In the *Salksen-spiegel*, where it treats of women's outfit and dowry, it is decreed that wild horses which have not always been guarded shall not be reckoned as part of such property. In a Westphalian document of 1316, the fishing, game, and wild horses of a certain forest are apportioned to one Hermann. Not alone in the time of the Merovingians, but at the end of the

sixteenth century, wild horses would seem to have lived in the Vosges Mountains, the wild borderland between two nationalities; for Rösslin, in his account of Alsace and the Vosges (Strasburg, 1593), thus circumstantially describes them: 'Horses that be of their kind much wilder and shyer than the stag; also much more difficult to take even in traps like the stag; yet when they are tamed, which is accomplished with great toil and trouble, they make the very best horses, that equal those of Spain and Turkey, and surpass them in many things, and are hardier, for they are accustomed to cold and to coarse food, and are sure-footed, being as used to mountains and rocks as the chamois.'

"If wild horses were thus found in the cultivated west and south of Germany, they must have existed still longer in the wild country on the Baltic, in Poland, and Russia. In fact, we find innumerable proofs of this down to modern times. At the time of Bishop Otto of Bamberg, in the first half of the twelfth century, Pomerania was rich in all kinds of game, including wild oxen and horses. At the same period wild horses are mentioned as extant in Silesia, whence Duke Sobeslaus in 1132 'carried away many captives, and herds of wild mares not a few.' It is known, and is confirmed by many literary allusions, that till the time of the Reformation, and even later, the woods of Prussia were inhabited by wild horses. Toppen's *History of Masovia*

(*Geschichte Masurens*, Danzic, 1870) says: 'In the time of the Teutonic Knights, wild horses and other game were hunted for the sake of their skins. In 1543 Duke Albert sent an order to the commander at Lyck, bidding him take measures for the preservation of the wild horses.' Proofs of the horse being an object of chase in Poland and Lithuania are found far into the seventeenth century. As to Russia, it is sufficient to quote the remarkable words of Vladimar Monomach, Prince of Chernigoo, who lived from 1053 to 1125. He says of himself, in his posthumous exhortation to his sons (preserved in the *Lawrenthian Chronicle*): 'But at Chernigoo I did this: I caught alive and bound with mine own hands from ten to twenty wild horses; and as I rode along the river Ross (which formed a sort of boundary between the Russians and the wild Turkish Polovtsy), I caught similar horses with my own hands.'"

Other writers, as quoted by Colonel Charles Hamilton Smith,[1] refer to the colour of these Central European wild horses. Erasmus Stella, for instance, writes of the wild horses of Prussia as being like the domesticated species, but with soft backs, unfit to be ridden, shy and difficult to capture, but very good venison. They were again referred to by Andrias Schneebergius, who

[1] Jardine's *Naturalist's Library*, vol. xx. *Horses*, 2nd ed. p. 158; the first edition was published in 1841.

states that they were like the domesticated breeds, but mouse-coloured, with a dark streak along the spine, and dark mane and tail. They were not greatly alarmed at the sight of human beings ; but were extremely difficult to mount. Like other game, they were reserved for the table. The mention of dark manes and tails is very important, as it shows that these animals were not onagers, which appear to have ranged into Europe during the later part of the Tertiary period.

Reverting to Messers Heyn and Stallybrass, it has to be mentioned that, after the account quoted above, they suggest that these horses were not really wild, but the descendants of horses escaped from captivity.

"The fact," they write, "that in pre-civilised times Central Europe, as far as Spain, was covered with dense forests, makes the hypothesis that this region was one of the natural homes of the horse improbable, for this animal is a native of the steppes, needing wide grass-lands and space in which its speed could be of avail in escaping from the larger beasts of prey. The very way in which some of these facts are recorded seems to point to horses gone wild rather than to those originally wild. When the Vosges horses, though with difficulty, do get broken in ; when Duke Sobeslaus drives home herds of wild mares from Silesia ; when the fishing, the game, and the *vagi equi* of a Westphalian district

are assigned to Hermann, and the untended horses of an estate are not to be included in a bride's outfit—in all these cases we may suppose that only fugitive horses are meant. So the animals found in Pomerania by St. Otto, and in Prussia by the Teutonic Knights, may have been in a wild state, and yet the progeny of merely fugitive mares; and this becomes the more probable the longer those regions had been the scene of war and rapine."

On the other hand, it should be borne in mind that during the Stone Age Western Europe, as already mentioned, was undoubtedly the home of a small big-headed race of horse; and nothing is more likely than that herds of this or an allied race should have survived in certain districts till a much later epoch. As regards the argument that the whole of Central Europe was a forest-clad region during the Stone and Middle Ages, Dr. A. Nehring [1] has brought evidence to show that this is incorrect.

After mentioning his belief that these small Prehistoric horses were the ancestors of the modern breeds of Western Europe, Dr. Nehring [2] proceeds as follows:—

"The taming of the domesticated horse lasted, in my opinion, into the later Stone Age, and during that epoch there existed in Central and Western

[1] *Ueber Tundren und Steppen, der Jetzt- und Vorzeit*, Berlin, 1890.
[2] *Ibid.*, p. 189.

Europe vast steppe-like tracts, which supplied suitable nutriment to the wild horses, and afforded abundant space for their wanderings. . . .

"Even during the Middle Ages wild horses may well have existed in Germany; it is true that the objection has been made that the wild horse is a steppe-dwelling animal, and that in the Middle Ages there were no steppes in Germany. But this objection, in my opinion, is invalid. For admitting that the wild horse was originally a steppe-dwelling animal, it is by no means improbable that during the post-glacial epoch, when the steppes were becoming constricted and the country overgrown with dense forest, small, or even large, herds of wild horses survived in many districts."

These, it is added, may perfectly well have lived in the open tracts between the forest to a much later date without ever becoming forest animals; although, as mentioned later, some may have become adapted to a forest life. Much the same view as to the nature of these horses was taken at an earlier date by Colonel Hamilton Smith,[1] who regarded them as the ancestors of the modern eel-backed duns—that is to say, duns with a dark spinal stripe. In the Middle Ages they had, however, probably become more or less crossed with escaped domestic horses, as will be shown to

[1] *Naturalist's Library*, vol. xx. *Horses*, p. 159.

have been the case with the wild horses of Russia; additional evidence in this direction being the above-mentioned statement as to their coats being mouse-colour, which appears to be an indication of cross-breeding.

As regards the wild horses of the Volga-Ural steppes, commonly called tarpan, the best account is that given by the German traveller, Peter Simon Pallas,[1] in the early part of the nineteenth century, who wrote as follows:—

"The wild horses inhabit the steppes of Great Tatary and Mongolia, from the Dnieper to the Altai, and through the whole of Central Asia, in small herds, seldom fifty in number. Most of them are reddish grey or pale grey in colour, but the mane, the spinal stripe, and the tail are reddish brown, the muzzle is whitish, and the region of the mouth blackish. (There are, however, herds of different colours among them, which are due to wild horses having interbred with domesticated animals escaped from captivity.) They are inferior in stature to domesticated horses, and have larger heads, more slender limbs, and somewhat bigger ears, which are bent backwards at the tips in sickle-fashion. The forehead is swollen above the eyes, with a whorl of hair between the latter. The hoofs are small and almost cylindrical. The mane extends

[1] *Zoogeographia Rosso-Asiatica*, St. Petersburg, vol. i. p. 260, 1811.

from the space between the eyes [apparently a misprint for ears] to the shoulder-blades; it is moderately long, and half upright. In winter the coat is rough, long, and waved on the back; the tail is of moderate length. Young foals can be very easily tamed, but the adults are untamable. They gallop with wonderful speed, and scent human beings from a great distance, especially when they get their wind. . . . They frequent open undulating steppes, and avoid forests and mountainous localities."

If, as is almost certainly the case, the word eyes (*augen*) is a misprint for ears (*ohren*)—for the author mentions the presence of a whorl of hair between the eyes—and if we except the absence of mention of the scanty hairing of the tail, the foregoing description might serve very well for that of the modern Mongolian tarpan.

Other evidence was collected at an earlier date (1766) by S. G. Gmelin,[1] who states that the Russian tarpan was a small, clumsy-headed, mouse-coloured horse, with a short wavy mane, and the fronts of the legs black from the knees and hocks downwards. In some examples the ears were short and horse-like, but in others longer and more ass-like. The tail was in some cases bushy, and in others scantily haired, but always shorter than in domesticated horses. This account appears to

[1] *Reise durch Russland*, St. Petersburg (1770–84).

refer largely, if not entirely, to hybrid tarpans. The Russian tarpan is now extinct, but one skeleton is preserved in the Zoological Museum at Moscow, and a second at St. Petersburg. One of the last survivors would appear to have been a gelding received in August 1884 at the Moscow Zoological Gardens, which had been taken as a foal in the government of Cherson in 1866. According to Dr. W. Salensky[1] this animal agreed in the matter of colour with Gmelin's description: but it had a forelock, and the mane fell over to the left side. There were no chestnuts on the hind legs. That this animal was a hybrid is practically certain.

The great majority of naturalists have refused to admit the claims of the Russian tarpan in their earlier days to be regarded as truly wild animals. This view, however, Dr. Nehring,[2] as already mentioned, considers to be erroneous; and it seems most probable that even in Pallas's time there were some Russian studs of more or less nearly pure-bred tarpan, but that as time went on these became more and more mixed with escaped domesticated horses, so that to find pure-bred tarpan it became necessary to go further and further eastward.

A very important contribution to the history of

[1] *Wissenschaftliche Resultate der von N. M. Przewalski nach Central-Asien untergennomenen Reisen, Mammalia*, pt. i., St. Petersburg, 1902.

[2] *Ueber Tundren und Steppen*, pp. 92, 93.

the tarpan, although treated by naturalists with neglect, was furnished by Colonel Hamilton Smith.[1] After referring to the doubts which had been entertained by naturalists with regard to the existence of truly wild horses, this author proceeds as follows :—

"Whatever may be the lucubrations of naturalists in their cabinets, it does not appear that the Tatar or even the Cossack nations have any doubt upon the subject, for they assert that they can distinguish a feral[2] breed from the wild by many tokens ; and naming the former *takja* and *muzin*, denominate the real wild horse *tarpan* and *tarpani*. We had some opportunity of making personal inquiries on wild horses among a considerable number of Cossacks of different parts of Russia, and among Bashkirs, Kirghis, and Kalmuks, and with a sufficient recollection of the statements of Pallas, and Buffon's information obtained from M. Sanchez, to direct the questions to most of the points at issue. From the answers of Russian officers of this irregular cavalry, who spoke French and German, we drew the general conclusion of their decided belief in a true wild and untameable species of horse, and in herds that were of mixed origin. Those most acquainted with a nomad life, and in particular an

[1] *Naturalist's Library, Horses*, p. 160, 1841.

[2] "Feral" denotes animals originally escaped from captivity, as opposed to truly wild ones.

orderly Cossack attached to a Tatar chief as Russian interpreter, furnished us with the substance of the following notice :—

"The tarpani form herds of several hundred, divided into smaller troops, each headed by a stallion; they are not found unmixed, excepting towards the borders of China; they prefer wide, open, elevated steppes, and always proceed in lines or files, usually with the head to windward, moving slowly forward while grazing—the stallions leading and occasionally going round their own troop: young stallions are often at some distance, and single, because they are expelled by the older until they can form a troop of young mares of their own; their heads are seldom observed to be down for any length of time; they utter now and then a kind of snort, with a low neigh. . . .

"These animals are found in the greatest purity on the Karakoum (south of the lake of Aral) and the Syr Daria, near Kusnek, and on the banks of the river Tom, in the territory of the Kalkas, the Mongolian deserts, and the solitudes of the Gobi: within the Russian frontier there are, however, some adulterated herds in the vicinity of the fixed settlements, distinguishable by the variety of their colour and a selection of residence less remote from human habitations.

"Real tarpans are not larger than ordinary mules, their colour invariably tan, Isabella, or mouse,

being all shades of the same livery, and only varying in depth by the growth or decrease of a whitish surcoat, longer than the hair, increasing in midsummer and shedding in May: during the cold season it is long, heavy, and soft, lying so close as to feel like a bear's fur, and then is entirely grizzled; in summer much falls away, leaving only a certain quantity on the back and loins; the head is small, the forehead greatly arched, the ears far back, either long or short, the eyes small and malignant, the chin and muzzle beset with bristles, the neck rather thin, crested with a thick rugged mane, which, like the tail, is black, as also the pasterns, which are long: the hoofs are narrow, high, and rather pointed; the tail, descending only to the hocks, is furnished with coarse and rather curly or wavy hairs right up to the crupper; the croup as high as the withers: the voice of the tarpan is loud, and shriller than that of a domestic horse; and their action, standing, and general appearance resemble somewhat those of vicious mules."

It is added that the genuine wild tarpans are migratory, wandering northward in summer, and returning south in autumn; in this respect they differ markedly from the hybrid muzin.

The above description, it is important to repeat, was drawn up after the Peace of Paris in 1814 by Colonel Smith from Cossack reports, and it is

therefore only to be expected that in certain particulars, such as the alleged smallness of the head, the statement that the tail does not reach below the hocks, and the absence of definite mention of the white muzzle and the scanty hairing of the upper part of the tail, it should not accord precisely with the tarpan as now known to us. On the other hand, the reference to individual variation in colour and in the length of the ears is very noteworthy, and in accordance with the facts.

Before proceeding further, reference may be made to the description and figure in Colonel Smith's book (p. 304, pl. xvii.) of an animal for which the author proposed the name of *Asinus equuleus*. This animal was kept some time previous to 1841 in a livery stable in Park Lane, and was brought to the notice of Colonel Smith by Sir Joseph Banks, who had been informed by Lord Rivers of its existence, and that it indicated a new species brought from the Chinese frontier north-east of Calcutta. According to further information supplied at the stable, the animal was said to have come from some part of Chinese Tatary, that is to say, Mongolia.

After mentioning that at first he had some doubt whether the animal might not be a variety of the chigetai or the kiang, its describer proceeds to state that, on examination, he was convinced it was much nearer to the horse, adding that he believed

it to be identical with the breed or species known to the Chinese as "yo-to-tze."

The animal, which was a male, was described as being not quite five years old, and standing 4 ft. (12 hands) at the withers. In form it was distinctly "ewe-necked"; the mane, although longer than that of an ass, was upright; the tail (which, from the picture, appears to have been cut) was scantily supplied with long hairs nearly to its root, resembling that of a rat-tailed horse; and callosities were wanting on the hind-limbs.

As regards colour, Colonel Smith writes that it was entirely of a yellowish red clay tint, "excepting the black tips of the ears, the mane, and long hair on the tail, a well-defined line along the back extending down the middle of the tail, crossed by a broad bar of the same colour over the shoulders, three or four streaks very distinctly marked over the knees and hocks, the cannon-joints brown, and the fetlocks and pasterns down to the hoofs black, the hoofs and hide dark, the eyes brown."

With the exception of certain remarks on an Arab-like appearance of the muzzle and nose, this description would apply fairly well to some of the impure tarpans characterised by having fawn-coloured instead of white muzzles. It is true that the absence of chestnuts on the hind-limbs appears to be a difference, but these are always small in the Mongolian tarpan, and were sometimes absent in

the half-bred Russian animals. Bars frequently occur on the limbs of both types, and traces of a shoulder-stripe may be detected in some individuals.

If this animal was really a half-bred tarpan, it is important to notice that the name *Asinus equuleus* antedates the under-mentioned *Equus przevalskii*.

In spite of Colonel Hamilton Smith's clear assertion that the true wild tarpan was a native of the borders of the Gobi Desert and the adjacent districts, naturalists persisted in applying that name to the Russian half-breeds, and most of them more or less completely ignored the evidence of the existence of truly wild horses at the present day. There matters remained till the year 1881, when Mr. J. S. Poliakow[1] described the skin and skull of a reputed wild horse obtained a short time previously by the well-known Russian explorer Colonel N. M. Przewalski, to whom it had been presented by an official at Zaisan, and in whose honour it was named *Equus przevalskii*. Only a single specimen was obtained, and this was described as being intermediate in characters between the horse on the one hand and the kiang and onager on the other, having chestnuts on all four limbs as in the former, but only the lower half of the tail clothed

[1] *Proc. Imp. Russian Geographical Society*, 1881, pp. 1–20; the paper is translated into English in the *Ann. Mag. Nat. Hist.*, ser. 5, vol. viii. pp. 16, 26, 1881.

with long hair, as in the two latter. The general colour was described as dun, with a yellowish tinge on the back, becoming lighter towards the flanks and almost white on the belly, with no dark dorsal stripe. The short and upright mane, which was not continued forward as a forelock, was dark brown; and the long coat was wavy on the head. The skull and hoofs were stated to be horse-like.

In referring to this skin, Sir William Flower[1] made no mention of Hamilton Smith's account of the Mongolian tarpan, but suggested that the specimen might possibly prove to be an accidental hybrid between the horse and the kiang.

Twenty years after the description of the type specimen of *Equus przevalskii*—that is to say, in 1907—the Duke of Bedford received a number of tarpan colts from the Kobdo district of Western Mongolia, two of which were sent in the following year to the London Zoological Gardens, when one of them was figured by Dr. P. L. Sclater.[2] About the same time living specimens and a large number of skins were received at St. Petersburg, which formed the basis of the monograph by Dr. Salensky published in 1902, of which the full title has been already quoted.[3]

Adult tarpan cannot apparently be captured, but, by taking certain precautions, the Kirghiz are able

[1] *The Horse*, p. 79. [2] *Proc. Zool. Soc.*, 1902, pl. xiii.
[3] *Supra*, p. 81.

PLATE VIII

FIG. 1

FIG. 2

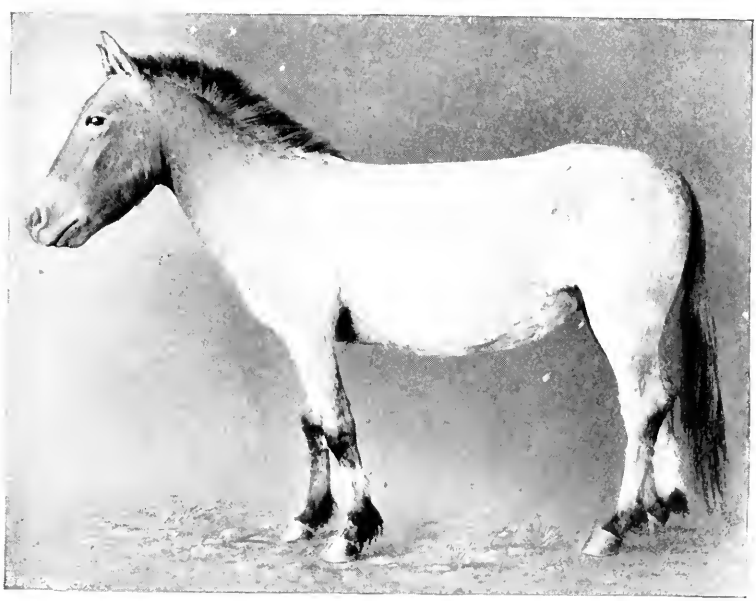


FIG. 1. A Mongolian Pony Mare, probably a half-bred Tarpan, used as a foster-mother to the Tarpan Colts brought to England for the Duke of Bedford.

FIG. 2. A Tarpan Mare.

to ride down and take the foals, which are snared in nooses. Those received in 1907 by the Duke of Bedford were brought from the Kobdo district of Western Mongolia by the agents of Mr. Carl Hagenbeck of Hamburg, who enlisted an army of Kirghiz for their capture. These foals were taken in three different areas in the neighbourhood of Kobdo; those from each area showing certain colour-differences, into the consideration of which it will be unnecessary to enter in this place; and it will suffice to state that these differences suggest that there has been some admixture with domesticated breeds.

The genuine wild tarpan may, however, be described as a big-headed pony, with a convex forehead, a short erect mane, and a tail covered with comparatively short hair on its basal portion, but terminating in a long tuft. Chestnuts and ergots are developed on all four limbs, as in most domesticated horses; the limbs are moderately slender, and the front hoofs are not unduly broad. The general colour of the upper-parts is dun, but on the nose and under-parts it becomes more or less markedly whitish; the mane (which does not extend on to the forehead to form a forelock), the tips of the ears, and the lower portions of the legs are black in front, and there is a distinct, although narrow dorsal stripe, while more or less defined shoulder-stripes and traces of barring on the upper parts of

the limbs are frequently developed. Although short in summer, the coat becomes long and shaggy in winter, when the mane displays a slight tendency to fall to one side; the hair on the fetlocks and lower jaw likewise showing a decided increase in length at the latter season.

The dentition is characterised by the relative shortness of the interval between the outermost, or third, incisor and the first tooth of the cheek-series, and the absolutely and relatively large size of the cheek-teeth themselves, as shown in plate v. fig. 1. This large size of the cheek-teeth is indicated by the circumstance that in a skull with a basal length of $18\frac{7}{8}$ the length of the row of six cheek-teeth is $7\frac{1}{2}$ inches, or only one-quarter of an inch less than that of the corresponding teeth in the skull of a shire mare, of which the basal length is 23 inches. Structurally the upper cheek-teeth are characterised by the absence of complex folding in the rings of enamel surrounding the central pits, and the relatively great length of the worn grinding surface of the anterior inner pillar, which is produced considerably in advance of the connection with the main body of the tooth, and is much flattened on the inner side; this feature being more pronounced in the premolars than in the molars. In a Dartmoor pony, with a skull of about the same size as that of a tarpan, the length of the row of cheek-teeth was only $5\frac{3}{4}$ inches; but this

is not quite a fair comparison, as the pony was an older animal than the tarpan, and the length of the tooth-row shortens with age. It is noteworthy that there appears to be no greater tendency to develop the small first upper premolar, or wolf-tooth, in the tarpan than in ordinary domesticated horses.

Relying on the local colour-differences referred to above, Dr. P. Matschie,[1] of the Berlin Museum, has expressed the opinion that there are two kinds of tarpan, namely *Equus przevalskii*, with a dun-yellow colour, very dark mane, and black legs, which he considers to be restricted to the neighbourhood of Zagan-nor, a lake lying to the south-east of Kobdo. On the other hand, the tarpan of the Urungu district to the west of Kobdo, and the valley of the Ebi, which are lighter in colour, with no black on the front of the legs, and a lighter mane, have been named by him *E. hagenbecki*. There can, however, be little doubt that the difference between the two types is due to an admixture of blood; and it is highly significant that the one which departs from the typical form occupies the western area or, in other words, is nearer to districts where there were formerly herds of half-bred tarpan. At the conclusion of his memoir on the tarpan, Dr. Salensky

[1] "Gibt es in Mittelasien mehrere Arten von Echten Wildpferden?" *Naturwissenschaftliche Wochenschrift*, Berlin, vol. xviii. pp. 581–583, 1903.

expressed the opinion that *Equus przevalskii* is certainly a distinct species, or race, although he declined to commit himself to any definite view as to its relationship to domesticated horses. In an appendix, dealing with a paper by Professor T. Noack, he admitted, however, that there is much to be said in favour of the view that a connecting link between the tarpan and some of the domesticated breeds may have once existed, and that this link may have been formed by one of the small horses of the Stone Age.

Before discussing the question as to whether the tarpan ought to be regarded as a species by itself or a race of the species typified by domesticated horses, it will be well to devote a few paragraphs to the Prehistoric horses of the Stone Age.

Structurally the molar teeth of these Prehistoric horses are of the same type as those of domesticated horses ; but, nevertheless, in the early days of palæontological science a number of scientific names were given to these fossil horses on the evidence of isolated molar teeth and other specimens which are no longer available for comparison, and, if they were, would be quite insufficient for determining the particular type of horse to which they pertained. In 1832, for instance, a German palæontologist, Hermann von Meyer,[1] proposed the name *Equus fossilis* for a horse represented by remains from the

[1] *Palæologica*, p. 79; Frankfurt-am-Maine, 1832.

superficial (diluvial) formations of his own country; and the title *E. adamiticus* had been given a dozen years earlier by Schlotheim[1] to the remains of the same or a closely allied type of horse.

At a later date the English naturalist Sir Richard (then Professor) Owen,[2] referred an upper molar of a horse from Kent's Hole Cavern, near Torquay, to von Meyer's *E. fossilis;* stating that it differed from molars of domesticated horses by its narrower crown—a feature that may perhaps be due to its belonging to the deciduous, or milk, series. Other upper molars from the cavernous fissures in the Devonian limestone of Oreston, between Plymouth and Tavistock, were assigned by Sir Richard Owen[3] to a second species, under the name of *E. plicidens*, in reference to the supposed more complex foldings, or pleatings, of the enamel in the central islands, or pits, of the grinding surface of the crown.

Twenty-five years later the same naturalist[4] described a number of equine remains from the cavern of Bruniquel, in the department of Tarn-et-Garonne, France. These, in place of being isolated molars, comprised specimens of the complete dentition, as well as limb-bones; and, from the relatively large size of the former as compared with the latter,

[1] *Petrefaktenkunde*, p. 11; 1820.
[2] *British Fossil Mammals and Birds*, p. 383, London, 1846.
[3] *Op. cit.*, p. 392, and *Rep. Brit. Assoc.* for 1843, p. 281, 1844.
[4] Owen, *Phil. Trans. Roy. Soc. London*, 1869, p. 544.

Sir R. Owen estimated the shoulder-height of the Bruniquel horse—for which, ignoring the earlier names quoted above, he proposed the designation *Equus spelæus*—at about 13½ hands, or 4½ feet.

Now it can scarcely be doubted that this small Bruniquel Prehistoric horse was identical with the small big-headed horse drawn on horn by the Stone Age men of La Madelaine, in the department of Dordogne (pl. vii. fig. 2), and the name *E. spelæus* will therefore be applicable to both.

The bones and teeth of horses from the superficial formations of the Continent and Great Britain indicate, however, great differences in the bodily size of the animals to which they belonged; and it has, therefore, been inferred that there were several distinct types of wild horses during the Stone Age. The evolution and differentiation of these types, it has been suggested, may have been due to the disappearance of the open tundras and steppes of Central Europe, and their replacement by forest, in consequence of which some of the wild horses took to a partially forest-life, which would lead to the development of a heavy and massive type of limb, while others, again, frequented the borders of deserts, where, it may be, they could exist only by the aid of man's cultivation of the soil in the oases.

From the study of remains obtained from Anau, in Turkestan, Dr. J. U. Duerst[1] considers that

[1] In R. Pumpelly's *Explorations in Turkestan*, vol. ii. p. 309; Washington, Carnegie Institute, 1908.

FIG. 1

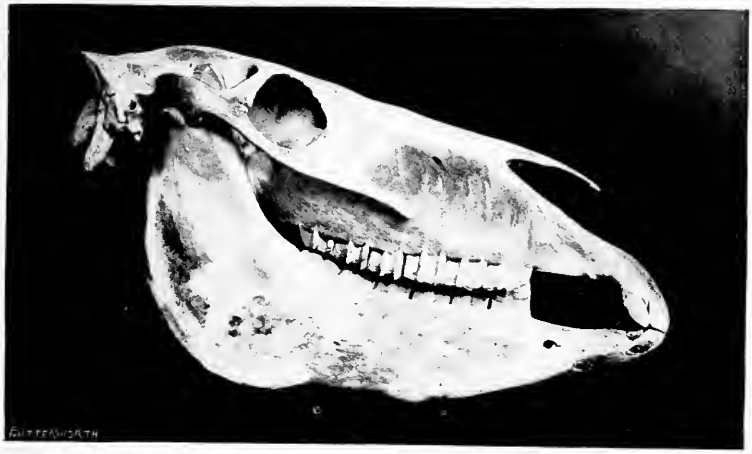


FIG. 2

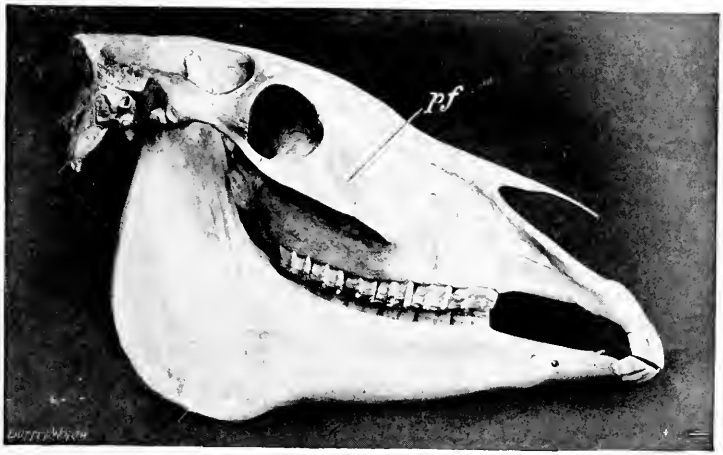


FIG. 1. Skull of a Young Tarpan Mare.
FIG. 2. Skull of an Arab Mare, showing the sinuous profile ; *pf*, preorbital depression.

from the Prehistoric horse of the diluvial period, which he regards as a local race of the species typified by domesticated horses, and therefore calls *Equus caballus fossilis*, three other races were developed in the late Stone Age. These he designates respectively as the desert-type (*E. caballus pumpellii*), the steppe-type (*E. c. germanicus* or *robustus*), and the forest-type (*E. c. nehringi*).

In a greater or less degree each of these, together with the rather earlier type identified by Dr. Duerst with *E. c. fossilis*, exhibits evidence of relationship with the Mongolian tarpan, which is regarded by the same writer as the direct descendant of the last-named.

The desert-type, as represented by the Anau horse of the Prehistoric deposits of Turkestan, is regarded by Dr. Duerst[1] as the direct descendant of *E. c. fossilis*. It was the smallest of all the Prehistoric domesticated horses, and may never have existed in a wild state. Having limbs of much more slender form than those of the tarpan, and very narrow hoofs, it was characterised by the medium width of the forehead as compared with the length of the base of the skull;[2] some of these features affiliating it to the Arab type, of which it

[1] *Op. cit.*, p. 431.

[2] Eastern and western horses are distinguished by a difference in the proportion of the width of the forehead to the basal length of the skull. As the proportion is low in the former, they are called "broad-fronted"; whereas the western horses, in which it is high, are styled "narrow-fronted."

is considered by Dr. Duerst[1] to have been the ancestor, although he also mentions near relationship to the tarpan. Bred, like the Arab, for speed and a desert-life, it is believed by the same writer to have been imported during the Bronze and Iron Ages into Europe, where it is well represented by the small horse of La Tène.[2] Dr. Duerst thus regards all existing domesticated horses as derived from a single ancestral wild type, namely, the extinct forerunner of the tarpan; such differences as characterise the various breeds being due to adaptive development. The subject is again referred to in the fifth chapter; but it may be mentioned here that the evidence for the derivation of the Arab from the Anau horse does not appear conclusive, as no account is taken of the possibility of that animal having a mixture of Arab and tarpan blood.

Very different from the last is the forest-type (*E. c. nehringi*), which was a small, stout horse, or pony, believed by Dr. Duerst[3] to have originated in the primeval forests of Germany, where it gradually became more and more stunted in size and thicker in the limbs, and where it was eventually domesticated. According, however, to Professor P. Matschie,[4] this small forest horse, or pony, is identical with a race from Würtemberg described

[1] *Loc. cit.* [2] *Ibid.*, p. 431. [3] *Loc. cit.*

[4] "Allerlei aus der Geschichte der Einhufer," *Monatshefte für Naturwiss. Unterricht*, vol. ii. p. 303, Leipsic, 1909.

at an earlier date by Dr. Woldrich as *E. c. fossilis latifrons*, which, in the opinion of the former writer, may have been the ancestor of the European Bronze Age pony, identified by Dr. Duerst with his *E. c. pumpellii*. The so-called Celtic pony, to which fuller reference is made in the sequel, is considered by Dr. Duerst to be a derivative from his forest type.

The steppe-type of the same writer, as primarily represented by *E. c. germanicus* of Nehring, from Westeregeln, Thiede, and Quedlinburg, was a bigger animal than either of the preceding, with the proportionately narrow forehead characteristic of the heavy horses of Western Europe. How nearly this type was connected with the horse of Solutré, in the Dordogne, north of Lyons, which was probably identical with the one depicted on the walls of the Madelaine Cave, in the same department (plate vii. fig. 2), and thus with the Bruniquel horse, is not clear, although it is probable that all these were of the same general character, and intimately allied to the Mongolian tarpan. Indeed Dr. Duerst states that some of the Solutré bones are absolutely indistinguishable from those of the latter. If this steppe-type be inseparable from the Bruniquel, Madelaine, and Solutré horses, it will be obvious that the name *E. c. spelæus*, as the earlier,[1] should replace *E. c. germanicus*.

[1] *Supra*, p. 94.

Although the cave, or rock-shelter, of Solutré could scarcely accommodate more than half-a-dozen families, however tightly packed, the entrance was protected by two walls of horse-bones, one a hundred and fifty feet long, ten high, and twelve thick, and the other forty feet long and five high. M. Toussaint, who explored this shelter of Prehistoric man, roughly computed the number of animals whose bones were thus stacked as forty thousand. So many in one spot could hardly have been tame; and, if they were, a large proportion would be old, but every one was quite young, many of them being foals, so that it is evident they had been killed in the chase, cut up, and brought home for eating.

It would be natural to conclude, writes Mr. F. Boyle in the *Cornhill Magazine* for May 1911, "that the hunters were horsemen. Boys would jump upon the back of a quarry wounded and overtaken; the sport would teach them to ride, and presently they would take to catching foals. All the steps of the process follow logically. But perhaps the first did not occur to our remote forefathers. Asiatics never thought of riding till they were infinitely more advanced; Gauls and Britons still clung to the chariot in Cæsar's time. The lake-dwellers were horsemen certainly—we find their bits and accoutrements. And they used the same breed of horse which the men of Solutré ate,

as the bones show. But that was a thousand years later, perhaps two or three or more."

In this place it may be mentioned that much has been made of certain differences in shape and in the degree of the hairiness of the head in the Prehistoric sketches of horses; such differences being regarded as indicative of racial distinction. But Professor H. F. Osborn[1] has well remarked that it is quite probable these differences may be due to some of the animals having been depicted in the winter and others in the summer coat.

A considerable amount of uncertainty and confusion exists, it will be noticed, in the foregoing determinations, especially in regard to the matter of scientific nomenclature; but the confusion becomes intensified when the views expressed above are contrasted with those held by Professor J. C. Ewart. According to one of the latest publications of that writer,[2] at least three species or races of wild horses inhabited Western Europe in Prehistoric times. The first of these constitutes his steppe-type, which seems to be typified by the Mongolian tarpan, but is provisionally taken to include the La Madelaine horse, for both of which the name *E. przevalskii* appears to be employed. This type, which is quite different from the one

[1] *Century Magazine*, November 1904, p. 15.

[2] "The Animal Remains at Newstead," in J. Curle's *A Roman Frontier Post and its People, at Newstead, Melrose*, p. 362, Glasgow 1911.

Dr. Duerst describes under the same name, is characterised by the large and heavy head and the relatively slender limbs, the face being long and narrow.

The second of Mr. Ewart's groups is the so-called plateau-type, which appears to be typified by bones and teeth from French and English Pleistocene deposits, and is said to be a fine-headed, slender-limbed pony, standing from 12 to 13 hands at the shoulder, with short grinding surfaces to the anterior pillars of the upper cheek-teeth, and a forehead of medium proportionate breadth. For this plateau-type Professor Ewart, on page 363 of the work just cited, adopts the name *Equus agilis;* remarking in a foot-note that it includes a northern or "Celtic," and a southern or "Libyan," variety. The name *E. agilis* was proposed by him in 1910[1] to replace *E. gracilis*, which he published in 1909,[2] but subsequently found to be inadmissible on account of having been previously used in another sense. In the original publication of the last-mentioned name, it was stated that it was meant to replace the inadmissible *Asinus fossilis* of Owen, and it was likewise mentioned that it was intended to include, as varieties, the author's *E. celticus* and the *E. libycus* of Professor Ridgeway. Such nomenclature is, however, totally inadmissible, the name

[1] Ewart, *Proc. Royal Soc. Edinburgh*, vol. xxx. p. 299, 1910.
[2] Ewart, *Proc. Royal Soc. London*, vol. xxxi. p. 392, 1909.

Equus caballus celticus having been proposed by Professor Ewart[1] in 1903 for the so-called Celtic pony of the North of Ireland, the Hebrides, Faröes, and Iceland, and therefore antedating the name *agilis*.

The third modification recognised by the same author[2] is the forest-type, which is said to be represented by remains from the so-called "elephant-bed" at Kemp Town, near Brighton, and by the aforesaid horse from the Palæolithic station at Solutré, northward of Lyons. This forest-type, which, it will be noticed, is different from the one so called by Dr. Duerst, is stated to have been a long low horse, probably characterised by a relatively broad and concave forehead, short, thick cannon-bones, wide hoofs, and long grinding surfaces to the anterior pillars of the upper cheek-teeth. The name *Equus robustus* (which Dr. Duerst regards as a synonym of *germanicus*) is adopted by Professor Ewart for his forest-type, as typified by the Solutré horses.

The recognition by the writer last named of a so-called Siwalik type—that is to say, one related to the Pliocene *Equus sivalensis* of India—among the remains at Newstead scarcely demands serious notice. On the other hand, it is important to mention that Dr. Marcellin Boule[3] has described

[1] *Nature*, London, vol. lxvii. p. 237, 1903.
[2] "Animal Remains at Newstead," *loc. cit.*, p. 363.
[3] *Annales de Paléontologie*, Paris, vol. v., 1910.

from the Grottes de Grimaldi, in Monaco, the remains of a large form of horse, which he identifies with the existing *Equus caballus*, but to which, very judiciously, he does not assign a separate racial name. This Prehistoric horse approaches the modern Percheron breed, to which it may have been ancestral. Bones and teeth indicating horses of equally large size have been obtained from the Brighton "elephant-bed."

From this long and somewhat wearisome survey of recent views in regard to the Prehistoric horses of Western Europe, which is essential in order to arrive at a satisfactory conclusion as to the systematic place of the Mongolian tarpan, it will be evident that during the period in question there were several more or less distinct types of wild European horses, differing from one another in bodily size, in the relative breadth of the skull, the degree of slenderness or stoutness of the cannon-bones, in the width of the hoofs, and to some degree perhaps in the conformation of the cheek-teeth. Some naturalists regard these different forms—or at all events a few of them—as distinct species; but by Messrs. Duerst and Boule they appear to be all considered as races, or phases, of the species typified by the domesticated *Equus caballus*—a view in which I myself fully concur. These races are not, however, precisely comparable to the geographical races of existing mammals recognised by modern

naturalists, no two of which ever occur in one and the same district. The races of Prehistoric horses, on the other hand, appear to have been dependent on environment, or "station," one being developed for a life on the open steppe, another in the forest, and another on grassy plateaus; and their remains may accordingly be met with in one and the same deposit, or, at all events, in closely approximated localities.

Furthermore, most, or all, of these Prehistoric types show more or less evident signs of near relationship to the Mongolian tarpan, while some of the existing Connemara ponies have been stated to bear the impress of descent from that animal,[1] or rather, it should be said, from its Prehistoric representatives of the Madelaine and Bruniquel caverns.

Before proceeding further it will, however, be advisable to refer to certain considerations in regard to domesticated horses. In the first place, attention should be directed to the fact that the name *Equus caballus* was given by the Swedish naturalist Linnæus to domesticated horses in general, without mention of any particular breed to represent what naturalists call the type, that is to say, the typical form of that species.

The same uncertainty obtains, however, with regard to certain species of European wild animals,

[1] See R. I. Pocock, *Harmsworth Natural History*, vol. ii. p. 796.

such as the red deer, the blue hare, and the fox, of which several local races are now known to exist; but naturalists have agreed to solve the difficulty by taking the Scandinavian, or rather the Swedish, representatives of such species as the respective types.

This being so, it is not only permissible, but likewise imperative, if consistency is to be maintained, to follow the same course in the case of the domesticated horse. Scandinavian horses may therefore be regarded as the typical representatives of the *Équus caballus* of Linnæus; and since among these the "eel-backed dun" is a very common and characteristic breed in Norway, it may perhaps be permissible to take this as the actual type of the species. This course was, indeed, proposed some years ago by Professor Ewart, but subsequently abandoned on account of the circumstance that dun horses may be produced by crossing two distinct Scottish breeds. This fact, in the professor's opinion, indicates that the dun is not a true breed; but it may be pointed out that if this view is admitted the typical blue rock-pigeon is not a true breed, let alone a species, because, as was pointed out by Darwin in his *Animals and Plants under Domestication*,[1] several distinct breeds of pigeons will, when crossed, revert to that type. And as what holds good for pigeons will like-

[1] Vol. i. p. 64.

FIG. 1

FIG. 2

FIG. 1. A Norwegian Dun Stallion, showing dapple.
FIG. 2. A Mongolian Polo Pony.

wise obtain in the case of horses, it follows that the production of duns by crossing affords decisive evidence of the antiquity of that type, being, in fact, a case of reversion to the ancestral form.

In colour the Norwegian so-called eel-dun is very like the tarpan, showing a narrow but distinct black dorsal stripe, and having the front surfaces of the limbs and the whole of the fetlocks black, while occasionally there may be traces of a shoulder-stripe and of barring on the upper part of the legs. In general form the breed is low in stature, but strongly built, with short, stout limbs. It should be added that, as mentioned later, two types of Norwegian duns are recognised; one of these being shown in plate x. fig. 1.

On the other hand, the head and cheek-teeth are relatively smaller than in the tarpan, the front hoofs are broader in comparison to the hind pair, while the mane is comparatively long and pendent, with a forelock, and the tail is well haired up to the root. Such differences may, however, perfectly well be regarded as the results of domestication, due in part, it may be, to selection, or in part, perhaps, to crossing with a second wild type, or its descendants.

This view in regard to the antiquity of the Norwegian dun type and its affinity to the wild tarpan accords exactly with the opinion of Darwin, who in the work already cited [1] wrote as follows: —

[1] Page 63.

"With respect to the primitive colour of the horse having been dun, Colonel Hamilton Smith has collected a large body of evidence showing that this tint was common in the East as far back as the time of Alexander, and that the wild horses of Western Asia and Eastern Europe now are, or recently were, of various shades of dun. It seems that not very long ago a wild breed of dun-coloured horses with a spinal stripe was preserved in the royal parks in Prussia. I hear from Hungary that the inhabitants of that country look at the duns with a spinal stripe as the aboriginal stock, and so it is in Norway."

To this it may be added that dun horses, although not necessarily of pure blood, were formerly common in Spain, where, as in some other parts of Europe, they were considered to be the worst type of all; the eel-backed being, however, a little better than the self-coloured dun.[1] Perhaps this is the reason why in the sixth chapter of Revelation the "pale horse," ἵππος χλωρός, that is to say, the horse of the colour of withered grass, or dun, is assigned to Death.

Be this as it may, the general tendency of the foregoing evidence is to show that the eel-dun horses of Norway and other parts of Europe not only represent a very ancient type, but that they

[1] See Ridgeway, *Origin and Influence of the Thoroughbred Horse*, pp. 260, 348.

inherit their colour, either directly or by reversion, from the wild tarpan. This led Darwin [1] to conclude that all the existing breeds of horses are probably descended "from a single dun-coloured, more or less primitive stock, to which our horses occasionally revert." And although in the light of the foregoing evidence as to the existence of more than one type of Prehistoric wild horse in Europe, this conclusion requires some little modification, it is probably not far from the truth, though the Arab may perhaps form an exception to the generalisation. It being admitted, then, that the wild Mongolian tarpan is related not only to some of the existing horses and ponies of Western Europe, but likewise to their Prehistoric ancestors, it seems only logical that it should not be separated from the species typified by domesticated horses, and its name will therefore be *Equus caballus przevalskii*, or, at all events, until it is definitely proved to be entitled to a designation of earlier date.

Adult stallions of the Mongolian tarpan stand about 13.1 hands (53 inches) at the shoulder; and, as might naturally be expected, its nearest domesticated representatives are the ponies of the same district, which measure from about 12.2 to 13.3 hands, and in their rough, untrimmed coats are very like their wild relatives, although they have developed long, flowing manes, with forelocks, and

[1] *Op. cit.*, p. 65.

tails which sweep the ground and are thickly haired to the root. These ponies are kept by the Buriats and other Mongol tribes in millions, and are extremely hardy and enduring. Mr. C. W. Campbell[1] states that "a good specimen of the Mongol pony is perhaps the best of his size in the world for general use. The head and shoulders will be too heavy for elegance, the eyes none too full, the muzzle and crest coarse, and the manners too often objectionable, but the quarters, loins, and legs are good, the barrel is deep and long, and there is no deficiency in bone. . . . The size and character vary with the locality. The commonest colour is grey, chestnut follows, and then come bay and sorrel. Stallions are selected animals, especially in North Mongolia, but the mares are not, and no special pains are taken anywhere to improve a breed. Along the China border the ponies are undersized, 12 to 13 hands, the result of the excessive demands of the China markets for all the larger beasts. As one travels northward, and the China market becomes more remote, the horse-flesh improves (12 to 14 hands), and the best specimens of the Mongol pony are found in the valley of the Kerulon."

Mongolian ponies (pl. x. fig. 2) are brought down to China in large droves for racing and polo purposes;

[1] *Report to Parliament on a Journey to Mongolia*, London, 1904, p. 35.

the majority going direct to Shanghai, although some are sold *en route* at Pekin and Tientsin. According to a writer in the *Field* newspaper of April 8th, 1911, "they are sold principally to the large race-owners for comparatively big prices, and are kept and trained for the races. As these ponies have to be bought without any trial entirely on their looks, with shaggy coats and totally unacquainted with the proper use of a brush, many are soon found to be hardly fast enough for racing purposes. Sometimes, however, the weirdest-looking proves himself to be very fast, while some of the good-looking ones turn out badly."

The aforesaid variability in the colour of Mongolian ponies, and the comparative rarity of dun, seem to indicate that they are not pure derivatives from the tarpan; the same thing being, perhaps, indicated by the luxuriant hair of the mane and tail. According to Professor Ridgeway[1] such colour-differences are known to have been in existence so early as the second century B.C. The mare represented in plate viii. fig. 1 is one of the dark types of Mongolian ponies. Although most of the so-called Chinese ponies are really Mongolian, the southern provinces of China do produce a native breed of pony, which appears to be nearly allied to those of Anam, Siam, and Burma (mentioned below), but is very small,

[1] *The Thoroughbred Horse*, p. 132.

scarcely reaching an average height of 12.1. These ponies are, however, very strong and hardy.

It may be added that the nomad Mongols devote great attention to breeding ponies, of which they possess an immense number, although many of them are spoilt by having their hoofs and teeth abnormally worn down by the stony nature of the ground and the hard herbage on which they feed.

Ponies more or less nearly related to the Mongolian are to be found throughout the vast tracts of Central Asia lying between Siberia and the Himalaya, since, in the opinion of Captain Hayes,[1] the ponies of Bhutan, Nepal, Spiti, and Yarkand are of the same general type; Yarkandis being not infrequently dun. The ponies of Corea, as already mentioned, are closely allied to those of Mongolia, and come equally close in general characters to the wild tarpan.

Here it may be well to mention that there is no near resemblance between Mongolian ponies and the eel-backed dun horses of Norway, such as might be supposed to occur in breeds derived from the same ancestral stock. A moment's reflection will, however, show that in this particular case no such resemblance is to be expected; for if the wild horse was domesticated in regions so far apart from one another as Mongolia and Norway, it

[1] *The Points of the Horse*, London, 3rd ed., p. 599.

is only reasonable to presume that differences in climatic conditions and in the mode of treatment and selection, coupled in all probability by an admixture of different kinds of alien blood, would produce a marked difference between the eastern and western domesticated stock.

Reverting to the Far East, it is important to observe that, as was long ago pointed out by Darwin, in most of the countries lying to the eastward of the Bay of Bengal, including Burma, Anam, Siam, the Malay Peninsula and Islands, the Liu Kiu Islands, and a large portion of China, the horse is represented only by small breeds which come under the designation of ponies. Among these, the Burmese or Shan ponies, which are mainly, if not exclusively, bred by the hill-tribes of the Shan States, in the interior of the country, are believed to be nearly related to the Mongolian breed, although probably modified by the infusion of foreign blood. In stature they are about the equals of the Mongolian, and are strong and active, although somewhat slow in their movements. On the other hand, the still smaller but closely allied Manipur ponies are much faster, and are used by their owners for polo, of which game Manipur is one of the original homes.

Near akin to the Manipuris are the Batak or Deli ponies of Sumatra, which are bred in the Batak hills of that island, and are exported to

Singapore from the port of Deli in large numbers. With their handsome, high-bred-looking heads, and high-crested necks, they differ, however, markedly from the Mongolian and Yarkandi types, which are often more or less decidedly ewe-necked; this difference being due to a strong infusion of Arab blood. In stature they average only about 11.3 hands, although some reach 12.1 or 12.2. Although most are brown, skewbalds are by no means uncommon. Sumatra also possesses a second breed of ponies, which take their name from the Gayoe hills, at the northern end of the island. According to Captain Hayes,[1] they are stouter in build than the Batak ponies, with shorter and thicker legs and heavier hind-quarters. They lack, however, the speed and fiery nature of the latter; this being probably due to their having a smaller strain of Arab blood in their veins.

On the other hand, the ponies of Java and some of the neighbouring islands, which, like those of Sumatra, not infrequently show distinct striping, appear to be, not only of very modern origin, but mainly of Arab descent, although it is quite probable that they may have some Mongolian blood. I am credited[2] with the statement that some Javanese and Sulu ponies show a large first upper premolar, or wolf-tooth, and as the same feature characterises the extinct Indian *Equus sivalensis*, the suggestion

[1] *Op. cit.*, p. 633.

[2] Ridgeway, *op. cit.*, p. 142.

was thrown out that the former might be the direct descendants of the latter. Although I no longer maintain such a view, it may contain a certain element of truth, since Arabs, as mentioned later, may perhaps trace their origin to the aforesaid *Equus sivalensis*.

Before leaving this part of the subject it is important to observe that the Burmese and Malay countries have derived their ponies from Mongolian or Arab stocks, and had no indigenous breeds of their own.

The tarpan has also had a share in the production of the Turkoman horses of Turkestan, which undoubtedly have been produced by crossing Mongolian ponies with Arabs. In fact, the Turkoman horse passes insensibly through the Persian into the Arab. A very similar pedigree may be assigned to the well-known dun-coloured ponies of the Kathiawar district of North-western India, which frequently show transverse dark barrings on the legs, accompanied in some cases by traces of shoulder-stripes, and always by a narrow dark spinal stripe. The limbs are long and slender, and the ears large, with a decided tendency to turn inwards at the tips. In the opinion of Professor Ridgeway,[1] "There can be no doubt that the Kathiawar horse is a cross between the dun-coloured horse of Upper Asia and the Arab;" there being historical evidence to show that so early as the commencement

[1] *Op. cit.*, p. 159.

of the Christian era large numbers of the dun horses of Northern Asia and Europe had been imported into the districts on the east side of the lower part of the Indus valley. The striping in the Kathiawar ponies, which is most marked in the best examples of the breed, appears to be a reversion to the ancestral type, as the result of crossing.

The foregoing does not, however, by any means exhaust the extent of the influence of the tarpan on the domesticated horses of Eastern Central Asia, for Tibet is the home of a breed of ponies many of which are cream-fawn, or yellow dun, in colour. Many of these dun ponies, according to Mr. L. A. Waddell,[1] are brindled, and in one particular individual a dorsal stripe, the tips of the ears, and stripes on the shoulders, flanks, and limbs were black, while there were dapplings on the haunches, as in many of the Mongolian ponies. More remarkable still are the so-called tanghans of Tibet, which are of larger size, and stated to derive their name from the Tanghastan district of Bhutan. They may be either piebald, or skewbald, with or without stripes, and, according to Colonel Hamilton Smith, the chestnuts on the hind-legs are extremely small. Some of the older travellers state that droves of tanghans were to be found in a wild condition on the Tibetan side of the Himalaya; but, in one instance, at any rate, there appears to be a confusion

[1] *Among the Himalayas*, p. 248.

between horses and kiangs, and in any case, if tanghans were found wild, they must have escaped from captivity. As regards their origin, Professor Ridgeway[1] states that "on the whole the balance of probability is in favour of the piebald colour of the tanghans[2] of Tibet being due to the crossing of the Mongolian and Arab stocks, as seems certainly the case with the piebalds of Sumatra."

The ponies of the Mongolian type which formed the ancestral stock of the modern Kathiawaris were probably brought into Western India by the ancient Scythians from the neighbourhood of the Caspian; and as these warriors also invaded Baluchistan and Afghanistan—the ancient Bactria—there is little doubt that the horses of these countries have a strong Mongolian element in their blood, although some of this may have been derived from the districts lying immediately to the north. On this point Captain Hayes[3] remarks that the Cabuli, Baluchi, and other trans-Indus horses so largely used in India, which, although stouter and shorter in the legs, are less smart in appearance and less suited to a hot climate than the so-called "country-breds," may be considered as intermediate between the latter and Mongolian ponies; this being, in fact, equivalent to saying that they are of mixed Arab and

[1] *Origin of the Thoroughbred Horse*, p. 156.

[2] I have ventured to alter Professor Ridgeway's spelling, "tangums," to accord with that adopted here.

[3] *Points of the Horse*, 3rd ed. p. 603.

Mongolian blood. Stripes, it is said, are not infrequent on the legs of horses in the Waziri districts of Afghanistan, as they certainly are on those of many of the ponies in the Punjab.

When the origin of Punjabi and other Indian ponies is considered, we are, however, at once confronted by great difficulties. For during the Pleistocene period the Narbada district of Central India, and doubtless other parts of the country, were the home of a wild horse (*Equus namadicus*) with long grinding surfaces to the anterior pillars of the upper cheek-teeth. And this horse—if indeed it is entitled to that name in the more restricted sense—may quite probably have had a share in the origin of the Indian country-bred and pony stock previous to the introduction of Arab and Mongolian blood. On the other hand, there is no proof that the extinct Narbada horse was not nearer to the onager than to the typical horse.

In concluding this chapter reference may be made to the diet of Asiatic horses. In the work quoted on page 69 Colonel Phillott observes that:—"Indian country-breds will eat and thrive on food that would probably kill English horses. In the Persian Gulf and elsewhere locusts, fish, and dates are regarded as legitimate food for horses and cattle; in Tibet the tanghans are given pig's blood and raw liver; and in the cold regions of Central Asia meat is regarded as a necessity for horses."

CHAPTER III

HORSES AND PONIES OF THE BRITISH ISLANDS

When Julius Cæsar invaded Britain in the year 55 B.C. he found the natives in possession of swift and hardy horses, which they drove in their war-chariots with remarkable skill and adroitness. Although it has been stated that the horse is not indigenous to the British Islands,[1] and the suggestion made that the original stock was introduced by the Phœnicians when they visited Cornwall for the purpose of obtaining tin, there seems no reason why the horses of the early Britains should not have been derived from the native Prehistoric breeds. The available evidence points to the conclusion that these early British horses were of small size, so that at the present day they would come under the denomination of ponies ; this being another fact in favour of their descent from the small Prehistoric horse allied to the tarpan. In the opinion of Sir Walter Gilbey,[2] it is doubtful whether the horses of Britain gained materially in size till the Saxons and Danes imported stallions belonging to larger breeds from the Continent.

[1] Sir Walter Gilbey, *Thoroughbred and other Ponies*, London, 1903, p. 21.

[2] *Op. cit.*, p. 22.

At the time when Domesday Book was written large droves of mares wandered at will through the forests of the great land-owners of England, and were only driven into enclosures occasionally when some of their number were selected for working purposes, and doubtless also for breeding. And it is probable that from these forest mares (the *Equæ silvestres* or *Equæ indomitæ* of Domesday Book) were produced the first improved types of British horses. From the unimproved forest breeds are doubtless descended the modern forest and moorland breeds of ponies; which, it has been suggested, have somewhat degenerated in size and quality owing to the poor fodder of the comparatively restricted areas on which they now survive.

The first of these ponies for notice are those of the New Forest, in Hampshire (pl. xi. fig. 1), which it has been suggested are descended from a stock found before the time of Knut (1017–1035) in the district formerly known as Ytene and afforested in the year 1072 by William the Conqueror.[1] They are described by Low as ugly, large-headed, and short-necked, but hardy, sure-footed, and capable of bearing rough usage. In 1765, the breed was much improved by "Marske," the sire of "Eclipse," having been allowed to run with the herds for about four years. In 1889 the Forest ponies were again improved by thoroughbred blood; and about the

[1] Gilbey, *op. cit.*, p. 32.

FIG. 1

FIG. 2

FIG. 1. New Forest Ponies.
FIG. 2. Shetland Ponies.

same time stallions from the island of Rum, off the west coast of Scotland, were introduced. These black Galloways, as they are called, greatly improved the stock, which is now in demand as polo-ponies. Near akin to the New Forest breed are the ponies of Exmoor and Dartmoor, the former of which should average 12 and not exceed 13 hands in height, while stallions of the latter may run to 14 hands. In winter these ponies, which are left nearly wild until caught for use, are thickly covered with long hair. Exmoors are generally dark bay or brown in colour, with black points; they have broad foreheads, sharp ears, well-formed shoulders, and short, sturdy legs.

From the larger types of these ponies were bred the old pack-horses of the west of England, which were indispensable in former days to the farmers of the district, and were also largely used for riding. Of late years Exmoor ponies have been crossed with Dongola Arabs, and this, and perhaps earlier crossings, may account for the Arab-like character they now frequently possess.

Welsh ponies, which are not confined to the principality, but range over the wilder parts of the adjacent counties of Salop, Hereford, and Monmouth, are more numerous than any other breed, and are a very ancient type. Early in the eighteenth century a famous thoroughbred stallion was turned out among the Welsh droves, so that in this case

also the modern breed has a tinge of Arab blood. According to the modern standard, North Welsh ponies should not exceed 12½ hands, but those of South Wales are allowed to measure 13 hands.

The ponies of the Lake District (Cumberland and Westmorland) run larger, so that many of them are entitled to be called Galloways. According to Sir Walter Gilbey they possess no features entitling them to be regarded as a distinct breed, and they do not therefore demand further notice in this volume.

Of much greater interest are the Connemara ponies of the west of Ireland, which inhabit the mountains of the Connemara district of Galway. It has been very generally asserted that these ponies were derived from horses saved from the wreck of the Spanish Armada in 1588. This, however, Sir Walter Gilbey[1] considers to be probably erroneous, and, in his opinion, the characteristics of the Connemara pony of the present day are due to the importation of Spanish, *i.e.* Barb, horses from England during the period extending from the fourteenth to the seventeenth century. Low, in his *Domesticated Animals of the British Islands*, states that Connemara ponies "are from 12 to 14 hands high, generally of the prevailing colour of the Andalucian horses, delicate in their limbs, and possessed of the form of head characteristic of the Spanish

[1] *Op. cit.*, p. 86.

race. . . . They are hardy, active, surefooted in a remarkable degree, and retain the peculiar amble of the Spanish jenet."

The existence of a large amount of Barb blood in Connemara ponies is admitted by Professor Ridgeway,[1] who gives reasons for believing that the ponies of Iceland, the Hebrides, and the Faröes were derived from Ireland, subsequently to the infusion of Barb blood into the latter country.

Now, as mentioned in the last chapter, the ponies of Iceland, Finland, the Faröes, Shetland, Hebrides, Connemara, Wales, and parts of England are regarded by Professor Ewart as indicating a special type for which the name *Equus caballus celticus* was proposed in 1903.[2] These ponies, of which the Iceland breed appears to be regarded as the typical representative, are collectively characterised, when pure bred, by the following features:—The height is about 12 hands, and the general colour very similar to that of the Mongolian tarpan. The head is small and delicately formed, the legs and hoofs are fine, and the hind chestnuts are lacking, as are also the ergots on all four fetlocks. The coat in winter is long and thick, the mane and forelock are properly developed, and the tail is luxuriant, with short hairs at the side of the base, which form a pad to protect the inside of the buttocks, and are

[1] *The Thoroughbred Horse*, pp. 419, 420.
[2] *Vide supra*, p. 101.

shed annually. The mane is darker externally than internally, and the tail is not wholly black. Some Shetland ponies conform to this type, but others are more sturdily built, with little or no tail-pad, and the ergots and hind chestnuts developed; and much the same may be said of the Connemara ponies.

As mentioned in the preceding chapter, Professor Ewart now regards the Celtic pony and the Barb (inclusive of the Arab) as divergent branches of a single primitive European stock.

To the Celtic type Dr. L. Stejneger[1] refers the fjord-hest of Western Norway, which he regards as distinct from the doele-hest, or "valley-horse," of the interior,[2] and as having been probably introduced into the country from Scotland. In his opinion the Celtic pony of Connemara and the Scottish Islands, the West Norwegian fjord-hest, and the now extinct Russian tarpan, all belong to the same stock. And he cites the evidence of a Russian naturalist, Professor Tscherski, who states that the hind chestnuts were frequently absent in the Russian tarpan; he himself adding that the latter resembled the Celtic pony in size and colour, and what is equally to the point, that its skull

[1] *Naturen*, Bergen, 1904, p. 161, and *Smithsonian Miscell. Collections*, vol. xlviii. p. 467, 1907.

[2] It is uncertain to which type belongs the horse shown in pl. x. fig. 1.

agrees essentially in relative proportions with that of the Iceland pony.

Assuming Dr. Stejneger's opinions to be trustworthy, it follows, in view of the near affinity of the Russian tarpan to its truly wild Mongolian namesake to which reference has been made in the preceding chapter, that if the Celtic pony and the Barb are divergent branches of a common ancestral stock, the Arab is first cousin to the Mongolian tarpan—a relationship which few will be disposed to admit.

But there is another way of looking at the matter, namely, that if we accept the evidence as to the infusion of Barb blood into the Connemara ponies, and also that the latter formed the source of the ponies of Iceland, the Hebrides, &c., the Celtic pony may apparently have derived its Arab characteristics from the same original infusion into an ancestral stock akin to the Prehistoric horses of La Madelaine and to the modern Mongolian tarpan.

The case has been put very concisely by Dr. R. F. Sharff[1] in a paper on horse-skulls from Ireland, in which it is remarked that "the principal point of difference seems to me whether the Arab or Libyan features, as Professor Ridgeway would call them, in the Irish [*i.e.* Celtic] horse are the result of introductions by mankind of Eastern

[1] *Proc. R. Irish Academy*, Dublin, vol. xxvii. ser. B, p. 85, 1909.

or Spanish blood, or whether these features were inherited from a wild ancestor. I believe that the latter was the case."

Others may, however, be permitted to hold the opposite opinion; and it is significant that Professor Ridgeway[1] has experienced the difficulty of accepting Professor Ewart's view, and attempted to get over it by suggesting a dual origin for the Celtic pony. That the latter is a recognisable type may be accepted independently of the views taken as to its ancestry and relationship. In connection with the latter point, the reader may be reminded that Dr. Duerst, as stated on page 97, derives the Celtic pony from his "forest-type" (*Equus caballus nehringi*), in which there appear to be no indications of Arab affinity. Reference may also be again made to the assertion (p. 103) that some Connemara ponies are very like the Mongolian tarpan; and it may be added that the short hairs on the sides of the base of the tail in the Celtic type may be another indication of relationship to the true tarpan, in which the whole of this region is short-haired.

Leaving theoretical matters, and resuming the consideration of the leading breeds of the British Isles, other than thoroughbreds, attention may be directed to the special features of the Shetland pony (pl. xi. fig. 2), which is the smallest of all.

[1] *The Thoroughbred Horse*, p. 421.

How and when these ponies, or rather the ancestral stock from which they are derived, reached the Shetlands is unknown, although some writers have suggested a Scandinavian and others a Scottish origin. From the circumstance that the "Bressay Stone," discovered at Bressay in 1864, includes among other designs the figure of a man on horseback, it has been inferred that ponies were found in Shetland previous to the extermination of Celtic Christianity by the Norwegian invasion of 872,[1] but the value of this evidence seems doubtful.

The general characteristics of "Shelties" have been already indicated when discussing the so-called Celtic pony. The average height is about 10 hands, 10½ hands being the maximum show-standard; but many do not exceed 9 hands. As regards colour, bay, brown, and dull black are the most prevalent shades, but these may be mingled with white, and in rare instances the whole coat may be white. Although in winter the coat is long, close, and shaggy, in summer the hair is quite short and sleek. It is stated that Shetland mares frequently have tusks as long as those of the stallions. As already mentioned, some Shelties are cart-horse-like in make, while others are of a more slender and Arab-like type. The frequent presence of black in the colouring is considered to be indicative of Norwegian, and thus of Barb blood.

[1] Gilbey, *op. cit.*, p. 103.

The ponies of Orkney are stated to be of a more mixed type, as well as larger in size and coarser in shape than those of Shetland. The Hebrides are also the home of numerous ponies; those of the Outer Hebrides being small, round-shouldered, and muscular, with thick and rough winter coats, while those of the Inner Hebrides are usually larger; Mull, Barra, Islay, Tiree, Skye, and Uist being the islands most noted for the good qualities of their ponies. Mr. Munro Mackenzie[1] states that the small ponies of Barra and the outer islands stand from 12½ to 13½ hands, and, although having rather large and heavy heads and straight shoulders, are hardy, serviceable animals. The ponies of Mull, Tiree, Skye, and Uist, as well as some parts of the west coast of the Scottish mainland, are a larger type, running from 13½ to 14½ hands in height; but are now very scarce. They are mostly blackish brown in colour, but some are brown, bay, or dun, others cream-colour, and a few grey. In this case tradition tells of infusion of Barb blood from horses saved from the wreck of the Spanish Armada; while other reports refer to the introduction of discarded Arab chargers by military officers. Certain it is that Arab characters are prevalent among them; and curiously enough, in the duns as well as in those of other colours. Whatever may have been the source of this Arab

[1] *Polo Pony Society's Stud Book*, vol. vii.

or Barb strain, all breeders and experts agree in attributing it to an introduced stock, and not to a primitive "Celtic" type.

A larger type met with in the Highlands of Scotland is known as the garron, and is specially characteristic of Perthshire and the central Highlands. Horses of this breed may stand as much as 15 hands at the shoulder; in colour they range from black and brown to dun and grey, bay being rare. In the opinion of Mr. Mackenzie they are probably the offspring of ponies crossed with larger horses brought from the south during military expeditions.

Intermediate between ponies and horses are the Galloways, so called from the district of Galloway, in the south of Scotland. Up to the end of the eighteenth century Galloways were generally under 14 hands, and were used alike for the transport of agricultural produce and for riding; but after that date they were crossed with larger horses till they practically disappeared from the mainland, to survive only in remote islands like those of Mull and Rum. The general colour was bright bay or brown with black points; but the Galloways of Rum, all of which were purchased in 1888 by Lord Arthur Cecil for the improvement of the New Forest breed, were black with hazel eyes. In all Galloways the head is small.

The Welsh cob appears to be an allied breed.

Since the present work purports to be an account of the natural history of the horse and not a treatise on horse-breeding, such groups as polo-ponies, hackneys (from the French *haquenée*), and hunters may be passed over without notice, since they constitute groups formed by selection from other breeds, rather than distinct breeds by themselves. Attention may accordingly be directed to the leading British types of horse employed for carriage and heavy draught. Among these, the first place may be assigned to the Cleveland bay, a magnificent stamp of powerful carriage-horses taking their name from the fertile district of Cleveland in the North Riding of Yorkshire, on the Tees, but now also largely bred in the East Riding, as well as in Durham and Northumberland. The name is, however, a modern one, the original local breed having been known as the chapman or pack-horse. How it originated is not definitely ascertained, although it was not improbably produced by the infusion of foreign blood into the native stock of the district. The colour of the Cleveland is bay with black points; and the height ranges from 16¼ to 16¾ hands. Heaviness of "bone" is one of the characteristics of the breed.

Near akin to the Cleveland bay is the Yorkshire coach-horse, which tends to be smaller in size, with what breeders term more quality; the latter being due to thoroughbred blood.

FIG. 1

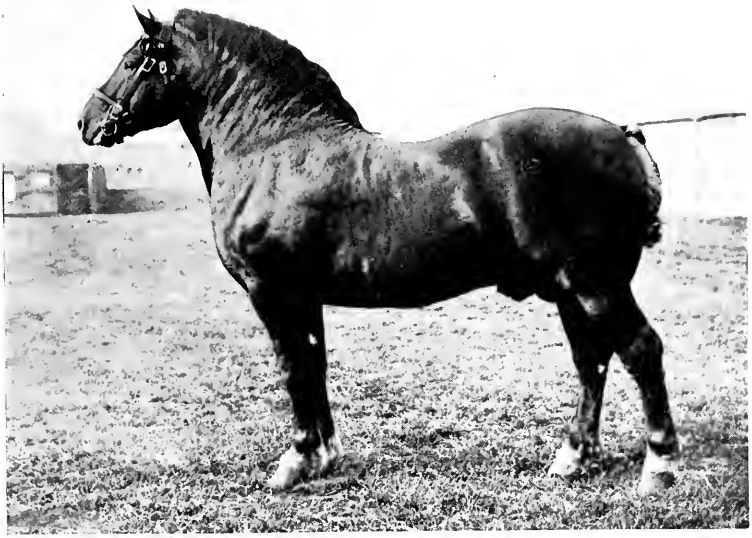


FIG. 2

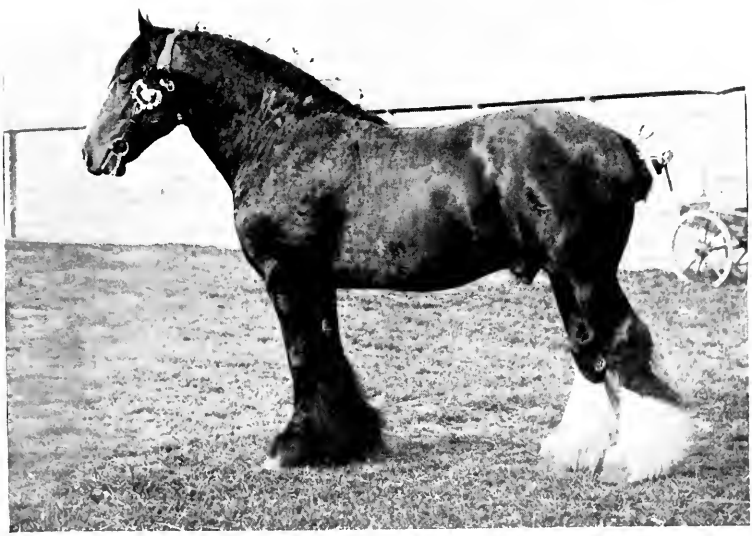


FIG. 1. A Suffolk Stallion.
FIG. 2. A Shire Stallion.

Of late years the tendency has been to render the Cleveland bay and the Yorkshire coach-horse lighter in make than formerly; and in consequence of this it is difficult to find a sufficient number of horses of the type required for use in the royal stables of this country, so that the stud of carriage-horses has to be recruited from foreign sources.

In this place it may be mentioned that the famous cream-coloured horses kept in the royal stables for use in processions of full state are a Hanoverian breed. Although frequently referred to as the "cream ponies," they are in reality horses of large size and great muscular power, the biggest standing fully 16 hands, and the smaller ones an inch or two less. The black Drenthe horses employed at royal funerals are another Hanoverian breed, mainly reared near Osnabruck.

Of the heavy draught horses of Great Britain one of the most famous is the Suffolk (pl. xii. fig. 1), frequently known, in allusion to its compact and "punchy" build, as the Suffolk punch, whose range extends from its native county into Norfolk and Essex. The original breed was noted for its hardiness and the capacity for exerting its utmost strength at a dead pull. A true Suffolk punch, it is written, would draw almost till he dropped; and a team at a given signal would, without a whip, bend in a moment to their knees, and drag everything along. When Low wrote his *Domesticated Animals of*

the British Islands the colour of the Suffolk was light dun or sorrel, sometimes deepening into chestnut, with a lighter mane and tail. The general shape was plain, with the head large, the neck short and arched, the shoulders low and heavy, the back straight, the haunches well developed, the loins wide, and the limbs short.

Low observed that "the colour distinctive of this variety connects it with the race widely diffused throughout the North of Europe and Asia, from the Scandinavian Alps to the plains of Tatary, in which the dun colour prevails. It is believed to have been carried to the eastern counties of England from Normandy, which yet possesses many fine horses of this breed, introduced, it may be believed, by the Scandinavian invaders."

Although there is no definite proof of such a Scandinavian origin, it is quite probable that it may contain an element of truth.

In the latter part of the eighteenth and during the nineteenth century the Suffolk horse was modified by crossing—notably with the Lincolnshire trotting horse; and nowadays the colour is generally either light or dark chestnut. From 16 to 16½ hands is the more general height, although some horses reach 17 hands. As the Suffolk is essentially a farm breed, and not intended for heavy work in cities, the weight should be less than in Clydesdales and shires.

North of the Tweed the most famous breed of heavy cart-horse is the Clydesdale, so called from the district watered by the Clyde in its course through the county of Lanark. The breed appears to be of somewhat mixed origin, Scotch drovers who took cattle to England in the early part of the eighteenth century returning with horses which were used for the improvement of the native stock. What these horses were is, of course, unknown; but it is certain that about the year 1715 a farmer introduced into Clydesdale a black Flemish stallion from England which formed the foundation of the modern breed. The mares descended from this stallion were generally brown or black, with the face white, some white on the legs, and a white patch on the belly; grey occurring abundantly in the tail, and occasionally on the body. Clydesdales are reared in Renfrew, Ayr, and Dumfries, although to the largest extent in their native Lanarkshire.

The average height of the Clydesdale is about 16½ hands for stallions and an inch or so less for mares. Breeders lay stress on the form of the feet, which should be large, round, and open, with abundance of "bone," and a free action. White feet, although common, are regarded as objectionable. A "dished" face, small ears, and a "pony" head are regarded as indicative of a strain of Galloway or garron blood; while, on the other hand, a narrow face and Roman nose point as

clearly to a shire cross. The feet should have long hair behind. As regards colour, bay or brown, with a blaze on the forehead, and the whole or part of the legs below the knees and hocks white, is the most prized; but black, grey, or chestnut occasionally occurs, the last of these being regarded as indicative of a shire cross.

The history of one of the most famous of the English heavy breeds, namely, the shire, or great, horse, has been fully worked out by Sir Walter Gilbey.[1] This breed (pl. xii. fig. 2) was probably derived from the chariot-horses of the Britons of Cæsar's time, and by the time of King John (1199–1216) had become the recognised English war-horse. With the increasing weight of armour, a heavier and larger type of horse became essential; and accordingly breeders directed their attention to the production of such a type. During the Wars of the Roses (1450-1471) large numbers of great horses were exported, in order to escape being seized for military purposes; but in the reign of Henry VII. (1485-1509) an Act was passed prohibiting the exportation of these and all other horses. In the succeeding reign—Henry VIII.—not only was this prohibition continued, but statutes were made for encouraging and improving the breed of shire horses. At this date the weight a charger had to carry (inclusive of his own armour)

[1] *The Great Horse, or Shire Horse*, 2nd ed. London, 1899.

was about 425 lbs., so that it is manifest a horse of great size and power was necessary. By Queen Elizabeth's time (1558-1603) the exclusive restriction of the great horse to military purposes was broken down, and these animals were in general use for farm and draught work. At this period it would seem that the colour of the great horse might range from black and bay to white. According to Sir Walter Hungerford, who lived during the reign of Queen Mary, the British breed was at that time improved by the introduction of High Almaine (German), Flemish or Friesland, and, more rarely, Neapolitan, stallions. In the reign of James I. the great horse was still in use as a war-horse, as is proved by Vandyke's picture of the Duke of Arenburg, in the Earl of Leicester's collection at Holkam Hall; and in spite of the introduction of lighter horses in succeeding reigns and during the Commonwealth, this usage continued till 1658, when a book was written by the Duke of Newcastle on the training and grooming of great horses for war purposes. By the latter half of the seventeenth century armour fell, however, into disuse, and the great horse, no longer required for war, or indeed for the saddle at all, took its place as an animal of draught, and eventually acquired the name of shire horse. It may be from the strain of North German and Flemish blood in the English great horse of best quality, that

in the time of Paul Potter, who painted a portrait of a grey dappled stallion of the breed in 1652, the British and Continental representatives of the breed were practically identical. The frequent presence of black and grey at this period is indicative of Arab or Barb blood.

The name shire horse seems to have been in use by about the end of the eighteenth century, for we find Arthur Young, in the description of a tour through England and Scotland, referring to two breeds of cart-horse as deserving of attention, namely the large old English black horse, "the produce principally of the shire counties in the heart of England, and the sorrel-coloured Suffolk punch, for which the sandy tract of country near Woodbridge is famous."

During the last century, writes Sir Walter Gilbey, "the shire horse has played no mean part in building up size and massiveness in all the other draught-breeds in the kingdom. That he has undergone great changes is certain; but the characteristics of the breed—size, strength, substance, courage, and docility—have been perpetuated and developed by careful selection till we have now in our shire horse the ideal beast of draught."

All the best characteristics of the breed were displayed by "Blythwood Conqueror," a famous stallion foaled in 1893, whose colour was bay, with a blaze on the forehead and all four feet white.

These white markings are, indeed, very distinctive of the breed, which is further characterised by the relatively small size of the head, the short and heavy neck, thick and powerful shoulders, rounded and deep body, short and broad loins, massive hind-quarters, and enormously strong limbs, of which the lower portions are short and compressed, with an abundance of long hair on the fetlocks, the hoofs large and rounded, the frog well developed, and the lower surface of the hoof moderately arched. Nowadays grey is much less common in this breed than formerly; the same being the case among thoroughbreds.

With such a build and size, shire horses are of course capable of performing extraordinary feats of power; and they have the further advantage of possessing a very docile and tractable disposition, which, under careful training, renders them extremely intelligent. Examples of this docility and intelligence are displayed by shires employed for hauling and shunting trucks on British railways.

The skull of a shire stallion is shown in plate iv. fig. 1, and a cannon-bone in plate i. fig. 1.

CHAPTER IV

SOME FOREIGN BREEDS

One of the most ancient and therefore one of the most interesting breeds on the Continent is the Schlettstadt horse, or pony, which has been described by Dr. Max Hilzheimer in an article entitled "Das Vosgesenrind und das Schlettstadter Pferd," published in the *Mitteilungen der Philomatischen Gesellschaft in Elsass-Lothringen* for 1906, vol. iii. pp. 368–380. This horse is to be met with in the neighbourhood of Schlettstadt, in upper Alsace, where it is locally known as Riedpferd (reed-horse) or Pickerle. Small in stature, and of all colours except grey, it frequently shows a dark dorsal stripe, while in one foal the last remnant of a transverse shoulder-stripe was observed, such a vestige being sometimes noticeable in the wild Mongolian tarpan. In its large and clumsy head, with a broad forehead, and a tendency to a concavity in the profile near the base of the nasal bones, the Schlettstadt horse likewise approaches the wild race, as it also does in its short ears and low withers. On the other hand, in its profuse mane and tail it makes an equally wide departure from

the latter, although there is every probability that these features are the result of domestication.

Dr. Hilzheimer is of opinion that this breed is the descendant of the wild horses—whether aboriginally so or reverted to a wild condition from domestication, is more or less immaterial—described by Elisæus Rösslin as having inhabited the Vosges at the end of the sixteenth century, and to which reference is made in an earlier chapter.[1] Moreover, he considers the Schlettstadt breed as nearly related to the horse of the Prehistoric Swiss lake-dwellings, or Pfahlbauten; and that the latter, to which some writers have attributed an Eastern origin, was itself the offspring of the still earlier wild horses of the cave-epoch, such as the one represented in plate vii. fig. 2.

On the other hand, it is suggested that the heavy so-called Eastern horse was not originally tamed to the west of the Alps or in the north of Europe, but that its ancestral home may have been in the neighbourhood of the Black Sea, whence it was carried by the Romans to Central and Western Europe.

According to Dr. Conrad Keller,[2] another ancient breed is to be found in the island of Majorca, in the Balearic group. These horses, which are most abundant in the Palma district, differ

[1] *Supra*, p. 74.

[2] "Studien über die Haustiere der Mittelmeer-Inseln," *Neue Denkschr. Schweiz. Naturfor. Gesellschaft*, vol. xlvi. pp. 107–187, 1911.

markedly from all other breeds. Specially characterised by their slender limbs and free, graceful carriage, they vary in colour from dark to light brown, and have short, thick, and arched necks, with thick, upright manes, which are often clipped.

The delicate head, with backwardly directed ears, is distinctly Roman-nosed, and when the animal is galloping, is carried sharply bent against the short neck. In this respect the Majorca breed differs markedly from Algerian and Andalucian horses, which carry their heads stretched out straight, nearly in the line of the neck. Dr. Keller compares the Majorca horses to those depicted on ancient vases and Greek coins, and believes the former to be the survivor of the ancient type.

This identification, if trustworthy, is of great interest, as it serves to indicate that the hog-manes of the early Grecian horses, like those sculptured on the frieze of the Parthenon,[1] were natural, although, as in the case of the Majorca breed, improved by trimming. This seems to be indicative of the affinity of both breeds to the wild tarpan; and affords further evidence that the falling manes of modern horses (other than the Arab) are due to domestication.

Of the heavy horses of France, perhaps the most famous is the Percheron breed (pl. xiii. fig. 1),

[1] See the cut on p. 297 of Ridgeway's *Origin of the Thoroughbred Horse*.

FIG. 1

FIG. 2

FIG. 1. A Percheron Stallion.
FIG. 2. A Belgian Stallion.

which takes its name from the district of Le Perche, in the south-east of Normandy. Although its origin is unknown, the Percheron is an ancient type; and it appears to have been largely crossed with Arab and Barb blood during the Saracen invasion in the early decades of the eighth century. In 1755 the breed was crossed with Danish horses, and subsequently English and Belgian stock was introduced, while in 1820 other foreign blood was infused by means of two grey Arab stallions, which no doubt had a considerable share in inducing the grey colour now prevalent in the Percheron. This modern breed forms an ideal type of draught-horse, the height being relatively low (from 15½ to 17 hands in stallions, and the maximum half a hand less in mares), and the body compact and rounded, with a full chest and broad back. The rump is, however, short, and the tail set low—a feature showing little indication in this respect of the Arab cross—and there is also a lack of depth and fulness in the barrel. The shapely legs and feet, devoid of large hair on the pasterns, are very characteristic, and the cause of the free action in walking and trotting. In fact, next to the Clydesdale, the Percheron has the best action of all draught-horses. The colour is usually grey or black, although browns and bays are not unknown. The breed has been introduced into America, where it has become very popular.

The Boulonnais breed, from the Boulogne district and the adjacent parts of Belgium, is a rather larger and coarser type than the Percheron, the neck being especially heavy, the rump steeper and more squared, and the colour frequently grey or white. The action is less free than in the Percheron. In Brittany the size of the draught-horses runs smaller, the normal height of the Breton breed being only from 14 to 15¼ hands. Like the Percheron, to which they are allied, these horses are often grey, although bay is more common than among the former. They have been largely crossed with other breeds.

Of less importance is the Nivernais, of the department of Nièvre, in Central France, which is now mainly a black breed produced by crossing the native stock with Percheron stallions.

Visitors on landing at Antwerp or other Belgian ports can scarcely fail to be struck with the intelligence, docility, and enormous power of the draught-horses employed on the quays. These horses (pl. xiii. fig. 2) belong to the Belgian breed, which is also used in the country for agricultural work, and appears to be of great antiquity; Belgium having been noted as a horse-breeding country since the time of Diodorus Siculus, in the first century B.C. There is a certain amount of local variation in the height of this breed, the largest being the Flemish strain, in which it reaches from 16¾ to

17 hands, whereas in the Brabant type it falls to between 15¾ and 16¾, while in the Ardennais stock, of the Ardennes, it is only from 15 to 15½ hands. The Picardy horses of France form a fourth modification of the present breed. Perhaps the most striking feature of the Belgian is to be found in the great fulness of the chest and the depth and breadth of the back; the girth of the body being relatively greater than in any other breed. The shortness and sharp inclination of the rump are more conspicuous than in the Percheron, and constitute a distinct blemish. Another frequent fault is the lack of sufficient stoutness of bone in the legs, and the small and narrow feet, which, as in the Percheron, are devoid of long hair. The neat head is carried on a short neck, which is frequently of great depth, and thereby shows another indication of affinity with the French breeds. On the other hand, chestnut is the prevailing colour, bays, bay-browns, and roans being, however, by no means uncommon, although greys are rare. Despite its somewhat slow action, the Belgian, on account of its weight, enjoys an unusual capacity for moving heavy loads with the least possible amount of exertion and strain.

As regards draught-horses of a lighter type, the rich lowlands drained by the Elbe, Weser, and Ems in North-western Germany have long been noted for the excellence of their breeds, among

which special mention may be made of those of Hanover, Oldenburg, Schleswig-Holstein, and East Friesland. The original black Hanoverian appears, however, to have died out some time subsequent to 1746. Near Osnabruck is kept the celebrated stud of black Drenthe horses, originally from Drenthe, in Holland, to which reference is made on page 129, in the preceding chapter, where there is also mention of the royal cream-coloured horses, whose origin is Hanoverian. The name of German coach-horse is applied to horses of the above stamp, whose height ranges from 16 to 16½ hands, and whose colour (exclusive of the creams) is almost invariably bay, brown, or black. The body is relatively large, with a high rump and well-set tail, the neck long and arched, the withers high, the legs relatively long, and the feet of excellent shape. The horses of Holland and Flanders are a heavier type of the same strain; and, as already mentioned, it is from the big black horses of this part of the Continent that the English shire draws many of its present features. Germany possesses many other breeds; but as these have been modified by crossing, they do not come within the scope of the present survey. Much the same may be said with regard to Danish horses; the principal breeding-ground for these is on the Oldenburg border. Reference has been previously made (p. 122) to the dun and other horses of Norway,

which are the most characteristic type of that country.

Hungary has long enjoyed a well-deserved reputation for its horses; and it appears that the old Hungarian horse was usually bay, although grey, dun, and chestnut were also known. Early in the nineteenth century this type was, however, completely changed by the introduction of English thoroughbreds. On the other hand, it is important to mention that there is an indigenous Austrian breed of horses, standing about 14 hands in height, and in their angular make closely resembling the ponies of the Russian peasantry. "It seems certain," writes Professor Ridgeway,[1] "that in these animals we have the descendants of the ancient ponies of the Danubian region, such as those driven by the Sigynnæ, and their resemblance to the country ponies of Russia confirms the conclusion that we have in them the old European-Asiatic horses more or less modified by crossing with superior blood."

Switzerland possesses several breeds of heavy horses apparently derived from the mediæval black war-horses, among which the Laumont breed of the Bernese Oberland forms an excellent draught-horse, whereas the black Erlenbuch is of lighter make.

It would, however, be useless to devote more

[1] *The Thoroughbred Horse*, p. 345.

space to the horses of Europe (other than thoroughbreds, which are discussed later), since nearly all of them have been more or less crossed with foreign blood. Professor Ridgeway, for instance, points out in one passage[1] that "the black horses of Western Asia, Spain, and Italy all result from a mixture of the African bay [Barb] with the indigenous horses of Asia and Europe"; while in a second[2] he mentions that "Würtemberg possessed a notable breed of horses, the best of which result from imported Arabs with an admixture in a small degree of the English thoroughbred and the Trakehaen"; and in a third,[3] after referring to the modern origin of the Russian Orlov trotter, he observes that "there is only one heavy Russian breed of draught-horses—the Beetewk, called after the river of that name. . . . In 1712 Peter the Great was so struck by the good qualities of the horses of that locality that he imported Dutch stallions to improve the breed, and later on it was crossed with the Orlov trotter."

In connection with Russia, it may be mentioned that the Kalmuks and Kirghiz own half-wild troops of coarse-bred horses, doubtless derived in great part from the original tarpan of the steppes, and much less altered by crossing with alien blood than the horses of Western Russia. Kalmuk horses, which are largely used in the Russian

[1] *Op. cit.*, p. 320. [2] *Ibid.*, p. 344. [3] *Ibid.*, p. 350.

cavalry, are bred in the country lying between the Volga and the Ural, and stand about 15 hands in height. Kirghiz horses, on the other hand, are smaller, seldom exceeding $14\frac{1}{4}$ hands, and are reared in the steppes to the north-east of the Caspian.

The horses of Turkey can scarcely be said to form a distinct breed at the present day, being derived proximately from the ancient brown stock of Armenia, which itself originally came from Northern Asia, by crossing with Arab blood, which soon gained the predominance. Colonel Hamilton Smith[1] writes that "they have, from the ancient Turkoman blood, a tendency to Roman-nosed chaffrons and ewe-necks, but the head is finely set on; they are delicate, have very tender and irritable skins; but also they are docile, and graceful like gazelles."

Before proceeding to notice some of the modern Asiatic breeds, other than Arabs, a few lines may be devoted to the early history of domesticated horses in the countries at the eastern end of the Mediterranean. With the exception of a solitary reference in Isaiah to their employment in threshing corn, horses are mentioned in the Bible only in connection with military operations. In Syria and Palestine they appear to have been unknown before the time of David; but at that date they were used

[1] *Naturalist's Library, Horses*, 2nd ed. p. 232.

both in war-chariots and for riding, the chariot-horse being termed *sûs*, and the riding-horse *pârâsh*. On the Egyptian monuments horses appear for the first time about 1600 B.C. harnessed to the chariot of the sun; and it was not till a much later date that they were used for riding. Indeed in several Eastern countries the horse was employed for driving long previous to its use for riding. We find, for instance, in Assyria that the bas-reliefs portraying the conquests of Shalmanesir in Elam always show the Assyrians fighting in chariots while their enemies were mounted; and it is stated that Sennacherib was the first to put cavalry in the field. These were mounted archers, each of whom required to be attended by a running footman, who had his hand on the bridle while the mounted man discharged his arrows. Later on the bowman learnt to manage his steed without assistance; but there is stated to be no instance in the Assyrian sculptures of the use of the lance or sword by the cavalry of the period. It may be added that the heroes of the *Iliad* are always referred to as fighting from chariots, no mention being made of their mounting their horses before going into action.

As regards the origin of these Eastern horses of the early historic period, Professor Ridgeway[1] is of opinion that those first introduced into Egypt

[1] *The Thoroughbred Horse*, p. 220.

came from the countries lying to the westward of the upper part of the Nile Valley, and were therefore of the Barb type. On the other hand, the horses of Syria and Palestine in Biblical times, which were of various colours, are considered to have probably come from Persia or the adjacent countries;[1] the dun-coloured kadishes now found in the peninsula of Syria and Irak being a later introduction from Central or Northern Asia, and akin to the tarpan. The latter origin is likewise claimed by Professor Ridgeway[2] for the horses of ancient Babylonia (where they appear to have been introduced about 1500 B.C.) and Assyria; the first horses known in the Euphrates Valley thus being of the tarpan type.

For centuries Persia has been noted for the excellence of its horses, the typical breed being near akin to the Arab but rather taller and more slender in make. There are, however, other breeds in the country, such as the Turkoman and the half-bred Persian and Turkoman in the north-east; the Karadagh, a Cossack breed, in the north-west, near the Russian frontier; the Kurdish breed in the province of Kurdistan; and Arabs in the western and south-western districts. These Kurdistan ponies, which are usually grey or bay, came doubtless in the first instance from Northern Asia, and therefore have the same origin as the Turkoman;

[1] *The Thoroughbred Horse*, p. 211. [2] *Ibid.*, p. 198.

when crossed with Arabs, they are largely exported into Turkey. They stand from 14 to 14½ hands. The true Persian may be regarded as a derivative from the Turkoman stock, specially modified by a greater infusion of Arab blood.

The Turkoman, or Turki, horse takes its name from Turkestan, its original home, although it has spread into Persia, Armenia, and Asia Minor. There are several strains, of which the finest inhabit the country to the south of Lake Aral and the Sir Daria, or Oxus. Standing from 15 to 16 hands in height, and capable of great endurance, these horses have large, Roman-nosed heads, ewe-necks, slender bodies, and long limbs. Although generally bay or grey in colour, some of them are black with white feet. The speed of these horses and such beauty as they possess are due to Arab parentage, grafted on an original stock doubtless more or less nearly akin to the Mongolian tarpan; and it is noteworthy that the Turkoman horses to the north of the aforesaid line are much smaller and show much less evidence of Arab blood than those to the south of the same.

Farther east the Turkoman gives place to the Mongolian pony, and the nearly related breeds of Bhutan, Nepal, Spiti, Ladak and Yarkand, to which allusion has been already made in the chapter on the tarpan, where mention is likewise made of the striped dun Kathiawar horses and the piebald

tanghans of Tibet, both of which appear to be derivatives from the tarpan stock crossed with Arab blood.

Reference may, however, be made in this place to the horses of Northern Spain, which are quite distinct from those of the south. Many of them are grey and roan-grey, but in the sierras occurs a dun-coloured breed, in which the legs are frequently striped. That these are typical representatives of the old European dun stock may, as Professor Ridgeway[1] remarks, be doubtful, as their striping may be the result of cross-breeding; but even if this be so, their colouring is probably due to reversion to the original type. This is indeed practically admitted by Professor Ridgeway, who on the page just cited remarks that "the horses of the Asturias and other mountainous areas of Spain are probably descended from the European large-headed horse, which may have continued in a wild state in Spain down to the Christian era, since Posidonius mentions horses among the wild animals of Spain. Of course these horses may have been simply feral horses, but on the other hand there is no reason why genuine wild *Equidæ* should not have still survived in wild and mountainous districts."

[1] *The Thoroughbred Horse*, p. 260.

CHAPTER V

THE ARAB STOCK

By common consent the beautiful and hardy horses reared by the natives of the Nejd district of Central Arabia are acknowledged to display the finest development of which the equine type, as modified for speed alone, is capable. It is true, indeed, that they are outclassed both in the matter of stature and speed by the modern thoroughbred; but that animal is but a derivative from the Arab crossed with the blood of the horses of Western Europe and Northern Africa, and its superiority is solely a matter of careful selection and breeding. The type was fully present in the Arab, and has merely been improved and developed. That the Arab type, with which may be grouped the Barb of Northern Africa, is markedly distinct from the original tarpan-like horses of Western Europe—the so-called cold-blooded horses of the Germans—is admitted on all hands; and the only question is as to the extent and degree of this difference. In other words, are the Arab and the Barb referable to *Equus caballus*, as typified by the original horses of Scandinavia, or do they represent a species by

themselves? Are they, in fact, the product and result of special selection and breeding, like the modern thoroughbred, or have they existed in practically their present form since the natural evolution of the horse tribe was completed?

To this question, which is by far the most important and far-reaching one connected with the history of the horse tribe, there is, unfortunately, no possibility of giving a decisive and indisputable answer. Consequently, extreme divergence of opinion, both on this point and in regard to the original place of origin of the Arab-Barb type, prevails among those who have studied and written on the subject.

Colonel Hamilton Smith[1] seems to have adopted the view that the Arab is the product of breeding and selection, since he refers to it as the most artificial and the first of high-bred horses; and he is followed in this view by General W. Tweedie,[2] who remarks that "if special and exclusive breeding directed to a certain object explains our English race-horse, there is no need to go further for the secret of the Arab's foray-mare." No explanation is, however, given as to the stock from which the Arab horse was developed by selection, although it is pointed out that there is no evidence that Persia was the original home. Moreover, there is the difficulty that, in the first place Arabs are

[1] *Naturalist's Library, Horses*, 2nd ed. p. 210.
[2] *The Arabian Horse*, London, 1894, pp. 74, 241.

unacquainted with the most elementary principles of horse-breeding, and secondly, that they did not begin to own and breed horses (at all events in the coast districts) till about the fifth or sixth century of our era. The latter fact would lead to the inference, on the assumption that Arabs were the originators of the breed to which they have given their name, that there were then no horses of this stamp in Palestine and Syria, which was not the case.

Moreover, if some Eastern nation, Arab or otherwise, was able to produce high-bred horses from a stock akin to the Mongolian tarpan, there is not the slightest reason why some of the nationalities of Western Europe should not have accomplished the same feat, which they certainly never did. And if the Arab was not thus evolved, it is clearly entitled to rank as a species apart from the original horses of Western Europe, which, as has been shown above, there is every reason to regard as descended from a tarpan-like stock.

A somewhat different view is taken by Mr. Wilfred Scawen Blunt,[1] the well-known breeder of Arabs, who, after alluding to the fact that these horses have been maintained by the Bedouin for at least 1300 years, that is to say, from the sixth century of our era, goes on to observe that

[1] Article "Horse," *Encyclopædia of Sport*, 2nd ed. vol. ii. p. 426, 1911.

FIG. 1

FIG. 2

FIG. 1. The Darley Arabian.
FIG. 2. "Persimmon," the famous Thoroughbred Stallion owned by H.M. King Edward VII.

according to local tradition the Arab "is a separate wild breed kept pure in the desert from the time of his first capture and domestication; that his habitat was Nejd and the high plateaux of Yemen, and that he owes his distinguishing qualities to the fact that his original blood has never been mixed with that of breeds of inferior type. In physical science there is as yet nothing positively ascertained which would show this to be improbable. The high plateaux of Arabia, though all of them desert land, . . . are neither without pasture nor without water. It is unquestionable that the wild ass existed, if he does not still exist, in Yemen, and the wild horse, too, may have there existed." Later on it is added that "it is quite conceivable that in the gradual drying of the peninsula, of which we have geological proof, a section of the wild species may have found itself cut off in the south from the rest of its kind, and have developed there in isolation the special qualities we find in the Kehailan [Arab]."

From the concluding passage it may be inferred that the writer considers the Arab to be descended from the same species as that which gave rise to the ordinary horses of Western Europe; the argument will, however, stand just as well, and be even stronger, if the ancestral stock were regarded as a species by itself. In either case, some of the objections raised against the views previously

referred to will be applicable; and if the Arabs had these wild horses in their midst from Prehistoric time it is difficult to see why they did not domesticate them till the fifth or sixth century, previous to which they appear to have used camels.

As to the argument that we have no evidence of the former existence of wild horses in Central Arabia, the same negative testimony might once have been cited to prove that there were never elephants in Mesopotamia, whereas there is geological and historical evidence to show that a species closely allied to, if not identical with, the Indian elephant inhabited that country during the early part of the human era.

Professor Ridgeway,[1] on the other hand, believes Northern Africa to have been the birthplace of the Arab stock. "It is now clear," he writes, "that for many centuries before the Arabs ever owned a horse, all the Libyan tribes possessed a most notable breed, which in size, shape, speed, colour, and docility, very closely resembled the kohl breed of Arabia. As it has been shown that Egypt was exporting horses into Asia Minor in the time of Solomon, and that Arab tradition points to Egypt as the region from whence the best horses were obtained in the time of Muhammad, and as Egypt derived her horses in great part from Libya, we are justified in concluding that

[1] *The Thoroughbred Horse*, p. 246.

the ancestors of the kohl breed of Arabia came from North Africa."

While admitting that the statement with regard to the early date at which the Libyans were in possession of horses may be perfectly true, it by no means follows that these horses were derived from an aboriginally wild African stock. In the first place, all the existing wild African representatives of the horse family are either asses (quite distinct from the so-called wild asses of Asia), zebras, or quaggas. It is true, indeed, that remains of extinct *Equidæ* have been obtained from the superficial deposits of Algeria, and that these may be referable to true horses, more especially since many of the animals of North Africa are of a European type, and therefore quite distinct from those characteristic of the rest of the African continent. There is, however, no evidence that this was the case ; and the point is apparently considered of no importance by Professor Ridgeway, who has devoted a whole chapter of his oft-cited work to a discussion of the origin of the Libyan horse. For he labours to show that the latter is related to the zebra-quagga group. Indeed he once went the length of suggesting that the North African horse is derived from Grévy's zebra. As indications of zebra-affinities he affirms that African horses show a more marked tendency to be striped than breeds which have not the same blood in

their veins; and he also suggests that the white frontal star and stockings so commonly seen in African and Arab horses are remnants of the markings of zebras and quaggas. Whatever value may attach to the first argument, the second, as already mentioned in the first chapter, has been shown by Mr. Pocock[1] to be utterly untrustworthy, such white markings being merely one of the first stages in the development of albinism. Moreover, the absence of the hind chestnuts and the nature of the front ones in zebras and asses show wide divergence from the horse.

As a matter of fact, the theory of the origin of the Arab type from the zebra-quagga group has not a leg to stand upon; and this being so, there remains little to be said in favour of an African birthplace for the former. That horses of the Arab type have existed in Libya from a very early date may be freely admitted. But the same is the case with humped cattle and their derivatives, which, as has been shown in the present writer's volume on the ox, originally came from South-western Asia, and are probably derived from the wild bantin of the Malay countries. Moreover, there is good reason to believe that the other domesticated ungulates of Africa, such as sheep, goats, and swine, are of Asiatic origin; and there

[1] *Annals and Magazine of Nat. History*, ser. 8, vol. iv. p. 406, 1909.

is accordingly a *primâ facie* probability that a similar origin may be attributed to the domesticated horses of Africa.

This view is adopted by Mr. T. A. Cook,[1] who, after referring to Professor Ridgeway's Libyan theory, and stating that the Barb is as different from the true Arab as is the Turk from either, proceeds to observe that "as a matter of much greater probability, the kehailan, or Arabian, was the original type from which both Barb and Turk were early derivatives, and it was from the East, and not from the West, that ancient Egypt took her best breed, as eighteenth-century England took it later on."

As mentioned in an earlier chapter,[2] Dr. Duerst holds that the Arab had an Asiatic origin, and that, like the horses of Western Europe, it was a derivative from the tarpan stock; the intermediate form in the case of the Arab being his so-called desert type. "The wild ancestral form," he writes, "was the same for both [that is, the Arab and the horse of Western Europe]; it was the diluvial horse of the ancient world, which roamed as far as the loess-steppes and tundra-plains extended; and which, surviving in separate groups the disappearance of the tundras, was transformed, according to

[1] *Eclipse and O'Kelly*, London, 1907, p. 13.

[2] *Supra*, p. 96; the passage here quoted is from page 399 of Dr. Duerst's work.

the newly-developing regional physiographic influences, into the desert type, the steppe type, and the forest type."

It is now time to devote attention to the physical attributes of the Arab, of which, so far as general external features are concerned, an excellent summary is given by Prof. David Law,[1] who adopts the view that these are due to adaptation to surroundings.

"Arabs," he writes, "are more compact than the horses of Barbary, having a rounder body, shorter limbs, with more of sinew, or what is termed bone. Yet they are of the smaller class of horses, very little exceeding, on a medium, fourteen hands, or fifty-six inches, in height. As compared with the horses of countries abounding in the grasses, their aspect is lean, their form slender, and their chest narrow. But the slimness of figure of these horses is not inconsistent with muscular force; and their movements are agile, their natural paces swift, and their spirit is unmatched. The power of their delicate limbs is indicated by the well-marked muscles of the fore-arm, and the starting sinews of the leg. The shoulder is sufficiently oblique; the withers are elevated: the back is moderately short; and the quarters are good. The head is well formed; the forehead is broad; the ears are

[1] *Domesticated Animals of the British Islands*, 2nd ed. p. 476.

somewhat long, but alert; the eyes full and clear; the veins prominent. . . .

"These desert horses subsist on the scantiest food, and are patient of hunger and thirst in a degree unknown in any other races except the African. They feed on the scanty plants which the borders of the desert supply, and when these are wanting, on a little barley, with chopped straw, withered herbs, roots, dates, and, in cases of need, the milk of the camel. They drink at long intervals and in moderate quantities. They bear continued exposure to the fiercest heat, and day after day perform marches of incredible toil through the burning sands of the wilderness."

In the foregoing account sufficient emphasis is not laid on the absence of slope in the rump, and the consequent high setting of the tail; features differing markedly from those obtaining in the wild tarpan and its relatives. The average height is also under-estimated, many Arabs standing $14\frac{1}{2}$ or $14\frac{3}{4}$ hands.

The colour of Arabs is commonly bay or chestnut, frequently with a star on the forehead and one or more of the fetlocks white; but it may be black or grey, although never dun. For the various strains of Arabs, the reader may be referred to other works; and it will suffice to mention that the highest or pure-bred is the one known as *kohl* or *kehailan;* both names referring apparently to

the blackness of the skin, which is compared to antimony (*kohl*). Five strains of the kohl breed are generally recognised by the Bedouin, of which the kehailan is the first and best. Here it may be mentioned that the low-caste horses of the towns are termed khadishes by the Bedouin.

Taking both external and anatomical characters into consideration, Professor H. F. Osborn[1] has formulated the following features as distinctive of the Arab :—The skull is relatively short, very wide between the eye-sockets, which are high and prominent, giving the eyes a wide range of vision, while the profile of the face is concave (pl. ix. fig. 2) and the lower jaw slender in front and deep and wide-set behind. The chest is rounded, and the back and the loins are well "ribbed up," due to the fact that there are only five (in place of the normal six) lumbar or ribless vertebræ. The pelvis has a nearly horizontal position—a character connected with speed; the croup, or tail-region, is relatively high, and the number of caudal, or tail, vertebræ few. In the limbs the shaft of the ulna, or small bone of the lower part of the fore-leg, is complete; the cannon-bones are elongated and slender, and the pasterns long and sloping. Allusion is also made to the occurrence of a slight depression in front of the eye-socket, and to the statement that

[1] *Bull. Amer. Mus. Nat. Hist.* vol. xxiii. p. 259, 1907.

the bones are denser than in ordinary horses. The latter feature was not, however, observable in an American skeleton, although it may occur in desert-bred Arabs. The features to which the greatest importance are attributed comprise the sinuous facial profile (due to a relatively large brain), the absence of a sixth lumbar vertebra, the complete shaft of the ulna, and the shortness of the tail, which has sixteen in place of eighteen vertebræ. As regards the completeness of the ulna, it is noticeable that the same feature was observed in a skeleton of Grévy's zebra. Taken together, the foregoing distinctive features, in the opinion of Professor Osborn, are sufficient to justify the specific separation of the Arab, which appears to be descended from ancestors distinct from those which gave rise to the ordinary northern and western horses.

Fuller allusion has been made in a previous chapter[1] to the preorbital depression in the skull which appears to be characteristic of horses of the Arab and Barb stock. It should be added that in Arabs the cheek-teeth (pl. v. fig. 2) are relatively small in comparison with the skull, and that the upper premolars have their transverse diameter as large as or larger than the longitudinal one, which is not the case with the horses of Western Europe,[2]

[1] *Supra*, p. 22.

[2] See Duerst, *Animal Remains from Anau*, p. 386.

while the foldings of the enamel in all the cheek-teeth are rather more complex than in the latter, and the longitudinal diameter of the anterior pillar is proportionately small. The first upper premolar, or "wolf-tooth," is not infrequently developed in the upper jaw.

Professor Osborn adds that if the Arab is to be considered specifically distinct from the horse of Western Europe, it should bear the name *Equus africanus*, which was applied by Sanson[1] in the year 1869 to the Dongola breed. Professor Ridgeway[2] has taken objection to that name, and proposed to replace it by *E. libycus* or *E. caballus libycus*, on the ground that the Dongola horse is a half-breed, but such an objection is invalid. On the other hand, there is an insurmountable bar to the use of the name *africanus* owing to the fact that it was employed by Fitzinger in 1857 as the designation of the African wild ass, for one of the races of which, as will be seen in the sequel, it is still used. There is, however, the name *E. asiaticus*, proposed for the Arab by Sanson in the passage cited, which is free from objection; and that animal may therefore be known either as *E. asiaticus* or *E. caballus asiaticus*, according as to whether it is regarded as a species or a race.

In discussing the origin of the Arab, Professor

[1] *Comptes Rendus Acad. Sci. Paris*, vol. clxix. p. 1205.
[2] *The Thoroughbred Horse*, p. 477, 1905.

Ridgeway claims that India cannot have been the home of the ancestral stock, owing to the fact that during the historical period that country has been unsuitable for horse-breeding. The Narbada valley of Central India was, however, inhabited during the Pleistocene, or latest geological epoch, and probably within the human period, by an extinct horse (*Equus namadicus*), while a second species (*E. sivalensis*) has left its remains in the somewhat older (Pliocene) deposits at the foot of the Himalaya. Obviously, then, the argument that India (which at the present day nurtures the onager in Sind and Cutch) is unsuited to horses applies only to part of the existing epoch. Now the Siwalik horse agrees with the Arab in the degree to which the facial part of the skull is bent down on the basal axis, in the presence of a preorbital depression, in the great relative width of the upper premolars, and in the complexity of the enamel-foldings in the centres of all the upper cheek-teeth, and the shortness of the grinding-surfaces of their anterior inner pillars; the two latter features being, indeed, more developed in the extinct species than in the Arab, and thereby approximating to the condition obtaining in the extinct three-toed hipparion, as described in a later chapter. The extinct species has also a large upper wolf-tooth.

I have therefore suggested the possibility of

the Arab being the descendant of the Siwalik horse or some nearly allied species from Southern Asia, not necessarily India. It has been suggested that as the extinct *Equus stenonis* has likewise a pre-orbital depression and short grinding surfaces to the anterior inner pillars of the upper cheek-teeth, it may claim to be regarded as the ancestor of the Arab or the Siwalik species. It was not, however, a native of the countries where, in my own opinion, the Arab probably originated.

Turning to the Barb type, this breed has its native home in Morocco and Algeria, and in its original form stands from fourteen to fifteen hands at the withers. It is characterised by the flat shoulders, rounded chest, relatively long head, and, as compared with the Arab, the lower setting of the tail, the hair of which, like that of the mane, is profusely developed. The prevailing colours are dark bay, brown, chestnut, black, and grey. The skull has the same sinuous profile as that of the Arab; but the teeth have not been described. Formerly the Barb was extensively crossed with Syrian Arabs, while in Algeria it has of late years been much mingled with European horses, so that pure-bred animals are not easy to obtain. The Barb will thrive on as poor fare as the Arab, and is equally hardy in constitution and docile in temper, although somewhat less spirited. Several strains

of the Barb type are recognised by Col. Hamilton Smith, the first of which is reared by the Mograbins on the western side of the plains south of the Atlas, to whom it is known as *shrubat-ur-rich* (drinker of the wind). These horses, which may be either grey or brown in colour, are low and greyhound-like in shape, and carry very little flesh. More remarkable is the Bornu breed, from the district south of Lake Chad, which is stated to be greyish-white with black legs. The tail is set rather low, the legs and feet are beautifully made, and the body is relatively short.

A third breed occurs typically in the Dongola district of Nubia, but is also found in Alfaia and Gerri. Typical horses of this breed are stated to be very similar in make to the Bornu type, but those of Alfaia and Gerri are smaller. The normal colours are bay, black, and white, with white legs in the two former. Professor Ridgeway regards the black and grey Dongola horses as half-breds, but the evidence for this does not appear very conclusive.

The near relationship of the Turkish horse to the Arab has been already mentioned; and in Spain the jennet presents an equally close affinity to the Barb, from which it has undoubtedly been derived. Jennets, as might be expected, occur in their purest form in the southern provinces of Spain, especially

Andalucia, Granada, and Estremadura. Bay appears to be the predominating colour, next to which come black and grey. It has been very generally considered that Barb blood was first introduced into Spain during the Saracen Conquest, but Professor Ridgeway adduces evidence to show that the introduction occurred about a thousand years earlier, although a fresh infusion of the same blood was brought in by the Moors at the time they overran the country. Jennets are characterised by their easy pacing amble.

The horses of Northern Spain, which are smaller than jennets, but may have a certain infusion of Barb blood, are referred to at the end of the fourth chapter.

The influence which Arab and Barb blood has had on the indigenous breed of European and Asiatic horses has been incidentally mentioned in the course of the preceding chapters.

The triumph of the Arab-Barb stock, when mated with the best indigenous breed, has been the development of the English thoroughbred, although, as the latter is essentially a modern type, it can receive but brief notice in the present volume. It will accordingly suffice to state that although the English breed of fast horses had been undergoing a slow but steady improvement for centuries, and that an Arab stallion (the " Markham Arabian ") was purchased for King James I. in 1616, it was to three

horses, the "Byerly Turk," the "Darley Arabian" (pl. xiv. fig. 1), and the "Godolphin Barb," that the evolution of the modern thoroughbred is mainly due. The "Byerly Turk," taking his name from Captain Byerly, his owner, was imported in 1689; and from him was descended "Herod," who gave his name to one of the three great lines of English racing stock. The "Darley Arabian" was purchased in Aleppo during the reign of Queen Anne by the brother of his owner, Mr. Darley, of Aldby Park, Yorkshire in 1702.[1] He gave rise to "Flying Childers," and "Bartlett's Childers," from the latter of whom the famous "Eclipse," the great-great-grandson of the "Darley Arabian," and the founder of the Eclipse line, was descended. "Persimmon" (pl. xiv. fig. 2), owned by King Edward VII., was a direct descendant of "Eclipse," and affords an example of the great increase which has taken place in the stature of racehorses; his shoulder-height being 16¼ hands, whereas that of "Eclipse," who was considered an unusually big horse for his time, was only about 15½ hands.

"Persimmon" was foaled in 1893; his sire being "St. Simon," and his dam "Perdita II." He was winner of the Derby and the St. Leger in 1896, and of the Ascot Gold Cup and

[1] The date is usually given as 1710, but the picture at Aldby Park from which pl. xiv. fig. 1 is copied, is inscribed 1702.

Eclipse Stakes in 1897. His pedigree is as follows :—

PERSIMMON, 1893	St. Simon, 1881	Galopin, 1872	Vedette, 1854	
			Flying Duchess, 1853	
		St. Angela, 1865	King Tom, 1851	
			Adeline, 1851	
	Perdita II., 1881	Hampton, 1872	Lord Clifden, 1860	
			Lady Langden, 1868	
		Hermione, 1875	Young Melbourne, 1855	
			La Belle Hélène, 1866	

Lastly, we have the "Godolphin Barb," a dark bay horse with some white on the off hind-fetlock, who was purchased in Paris about 1784, and presented to Lord Godolphin (by whom he was regarded as an Arab). From his grandson, "Matchem," the third great line of English thoroughbreds derives its title. "Herod," "Eclipse," and "Matchem," it should be mentioned, were closely related; and it is to their descendants that the term thoroughbred should be restricted.

As the thoroughbred has been developed solely from the point of view of speed combined with staying power, it is only natural that he should not conform to the ideal type of equine beauty; and, as a matter of fact, the frequent presence of ewe-neck detracts from perfect symmetry. Neither are these horses safe to ride. They have the broad forehead, brilliant eyes, delicate muzzle, expanded nostrils, and wide throat of the Arab and the Barb, with the body long and light, and the last rib

rather widely separated from the pelvis. The chest is deep but narrow, thus affording due space for the lungs without making the fore-limbs too wide apart. The obliquity of the shoulder gives full play to the upper part of the leg; while the extreme length of the haunch, and the elongated hind-limbs, with their long, sloping pasterns, are essentially adapted for the maximum development of speed. The most common colour is bright bay or brown, with black legs, mane, and tail, although chestnut is not infrequent; but black and grey (especially at the present time) are less common.

Although, as stated above, the development of the English thoroughbred did not take place till the seventeenth and eighteenth centuries, it is important to mention that Irish hunters, which have long been celebrated, were derived from Barb horses imported into Ireland from Spain several centuries earlier.

Remarks on the inheritance of coat-colour in thoroughbreds and on a possible connection between colour and speed will be found in the first chapter.

CHAPTER VI

FERAL HORSES

ALTHOUGH the comparatively modern domesticated breeds produced in America, Australia, and other countries to which the horse is not indigenous do not come within the purview of this volume, reference must be made to horses which have run wild in various parts of the world, since some of these display features of considerable interest in connection with the history and evolution of the family. For domesticated animals that have escaped from captivity and reverted to a more or less completely wild condition, it is frequently convenient to employ the term "feral"; for, although this term, which is derived from the Latin *ferus*, is etymologically equivalent to the English "wild," it has acquired a special restricted meaning, which can be expressed by no other word in our language.

To North America horses were introduced during the Spanish Conquest, and their feral descendants, like those of South America, are consequently of Spanish origin, and therefore of the Barb type, just as the feral cattle were originally

of the zebu stock. Writing in 1829, Sir John Richardson stated that at that time herds of feral horses were to be met with on the plains to the west of the Mississippi; and that at an earlier date they were common in the Kutannie country near the northern sources of the Columbia River, to the east of the Rocky Mountains. The young stallions, which were expelled from the main herds by their seniors, formed troops by themselves.

Early in the eighteenth century feral horses abounded in Virginia; and as these enticed away the domesticated horses of the English settlers, the Spanish type became gradually modified. There are also herds in Texas, where they are known as mustangs, and likewise in Mexico; many of the former being piebald or skewbald.

The feral horses which formerly abounded on the pampas of Argentina appear to have been descended from five stallions and seven mares of Andalucian origin which escaped when the city of Buenos Aires was suddenly abandoned by its inhabitants about the year 1535. These rapidly multiplied, and gave origin to the herds on the pampas to the south and west of the Rio de la Plata; but the troops to the north of that river, in Paraguay, were derived from another stock. Although these horses frequently went about in small troops, each led by a stallion, these troops sometimes combined into herds comprising thousands of individuals. When the herds

sought fresh pastures, they were led by a few of the older stallions, who gave warning of impending danger. Like kiang[1] in Ladak, the herds come up to gaze at novel objects, and run in circles round bands of mounted travellers, who on such occasions find it difficult to prevent their own animals from escaping. When once caught, the wild horses of the pampas, like those of the North American prairies, soon re-acquire domesticated habits. It is stated that these pampas horses, or baguals, as they are called, have acquired larger heads, longer ears, and more muscular limbs than their domesticated ancestors; although, on account of the mildness of the climate, there has been no marked increase in the length of their coats. Very noteworthy is the statement[2] that "their colour is always of a chestnut-brown, and never dun, as in the Tatar races; and whenever a bay, a black, or other colour appears, it is inferred that the individual is of the domesticated race, and has made its escape and joined the wild herds." This affords further evidence in favour of the view that the Barb, or Andalucian stock, is descended from a species distinct from the wild dun tarpan of Mongolia.

Horses from La Plata, and therefore probably of the Andalucian type, were introduced by the French in 1764 to the Falkland Islands, where

[1] See chapter vii.

[2] See Low, *Domesticated Animals of British Islands*, p. 499.

they subsequently ran wild. According to Darwin, their predominating colours are roan and grey: like the domesticated cattle of the same inclement islands, they have become stunted in size, their average height being only about 14½ hands. It is stated that the Falkland horses, like the tarpan, have the habit of scraping away snow with their hoofs in order to get at the herbage beneath; and it is generally considered that this is an instance of reversion, although this can scarcely be the case if they are all of Andalucian, *i.e.* Barb, stock. The Puno ponies of the high Cordillera of Chile afford another instance of a dwarf feral race apparently derived from the same stock.

In *A Naturalist on the "Challenger,"* Professor H. F. Moseley states that in the peninsula of Lafonia, where the Falkland horses run larger than elsewhere, the stallions guard their own herds of mares. "They keep the closest watch over them, and if one strays at all, drive her back into the herd by kicking her. The younger horses live in herds apart, but the more vigorous ones are always on the look-out to pick up a mare from the herds of the older ones, and drive her off with them, and they sometimes gather a few mares for a short time and hold them till they are recaptured. When they think they are strong enough, they try the strength of the old horses in battle, and eventually each old horse is beaten by some rival and

displaced. The fighting is done mainly with the tusks, and front to front, not with the heels. Thus the most active and strongest males are constantly selected naturally for the continuation of the herds."

In most parts of America the feral horses appear to have no special difficulty in defending themselves from the attacks of predatory carnivora, such as jaguars, pumas, lynxes, wolves, coyotes, and bears. The case is, however, different in certain parts of Patagonia, where pumas are so numerous that wild horses seem unable to exist. It has accordingly been suggested by Mr. W. H. Hudson that these carnivores were the cause of the extermination of the indigenous American representatives of the equine family. The suggestion, however, was made at a time when the possibility of extermination being frequently due to bacterial agencies was not generally recognised.

The following extracts from a letter published by Professor Ridgeway[1] afford valuable information with regard to feral horses in Australia:—

"Wild horses have been running in the mountainous country of East Gippsland, in which are the sources of the Buchan River, and through which flow the Snowy River and its tributary the Deddik. To this I must add the dividing range from Omeo to Mount Kosciusko. These wild horses probably date back in places to a time antecedent to the

[1] *The Thoroughbred Horse*, p. 431.

discovery of Gippsland in 1842. On the Manero table-land, which lies on the New South Wales side of the border, and extends up to Kosciusko and Kiandra, and Sunit, as also from the country to the heel of the dividing range, I have no doubt that horses escaped and became wild. Of course these have been of all kinds. On the high mountain plateau which lies between the upper Tambo River and the sources of the Buchan River I have seen horses which can best be described as dwarfed cart-horses, and probably were the descendants of light draught stock used by prospectors and miners in the early times of gold-discovery—after 1850. The country they lived in is very high and cold, being covered in winter with snow, and altogether ill adapted to feral horses. In the warmer but very hilly country which lies to the east of the Snowy River in Victoria . . . the horses were of a much better stamp, in many cases showing good breeding, partly owing to the excellent stamp of the New South Wales horses of about fifty years ago, but also to the fact that a Persian horse . . . escaped and lived for many years in the Tubbut country."

In some of the above districts these brumbies, as they are locally called, became a nuisance to the settlers, by whom they were eventually exterminated, and a similar extirpation of feral horses has taken place, for the same reason, in other parts of the world.

CHAPTER VII

THE KIANG AND ONAGER GROUP

The wild Asiatic representatives of the *Equidæ*, other than the tarpan, are commonly known as wild asses, but they have really no right to that name, any more than they have to be called horses, in the literal sense of that term. Indeed, this does not really express the truth of the matter, for some of them are more nearly related to the horse than they are to the ass. Consequently it is far preferable to employ their native or classical names, such as chigetai, kulan, kiang, onager, and ghor-khar. The near relationship of these animals to the horse, and more especially the wild tarpan, may be made apparent by the following table :—

I.—All the hoofs broad, the front much broader than the hind pair.

i.—Front hoofs very broad, chestnuts usually on all the legs, ears small, tail more or less completely haired to root, front of fore-legs usually black in bay or dun-coloured individuals. The horse, *Equus caballus*.

a.—Mane long and pendent, with a forelock, tail long and fully haired, normally no dorsal or shoulder stripe. *E. c. typicus*. Domesticated breeds, typified by those of Sweden and Norway (exclusive of the Arab and Barb stock).

b.—Mane short and erect, basal portion of tail short-haired, a dorsal and a shoulder stripe in the summer coat, muzzle usually white or yellowish. The Mongolian tarpan, *E. c. przevalskii*.

ii.—Front hoofs less broad, chestnuts on fore-legs only, ears large, tail short-haired for a considerable distance from the root, front of fore-legs yellowish or white. The kiang and onager group, *E. hemionus*, &c., of Asia.

II.—All the hoofs narrow and nearly alike in form. This group includes domesticated and wild asses, zebras, and quaggas, all of which are African.

In addition to their broader front hoofs, the members of the kiang group are characterised by the absence of striping on the head, body, and limbs, the general rufous or sandy colour of the upper-parts, and the lighter tint of the under surface of the body, part of the buttocks, and the limbs, all of which may indeed be white. In all cases the spinal region is traversed by a dark dorsal stripe, varying in width in the different species; and occasionally faint bands are noticeable on the shoulders, knees, and hocks. As a rule, the mane, which is upright, and the terminal tuft of the tail, are black. To a considerable extent the cry, which in the case of the kiang has been described as a shrieking bray, is intermediate between the neigh of the horse and the bray of the ass, although apparently nearer to the former than to the latter. Kiangs and onagers are, however, distinctly less noisy animals than the ass; and in this respect present, perhaps, another point of resemblance to

the horse. The ears, although larger than in the horse, lack the excessive length and breadth distinguishing those of the ass. On the other hand, the members of the kiang group display affinity to zebras and asses, not only in the absence of hind-chestnuts, and the large size and smooth surface of the front ones, but likewise in the length of the period of gestation, which is about a twelvemonth, whereas the mare only goes with young for eleven months.

Of all the members of the group the largest, and in some respects the finest, is the kiang (*Equus kiang*) of the elevated plateaux of Ladak and Tibet, where it goes about in small troops, which gallop in circles round the mounted traveller or his camp in such a manner as to completely prevent in many instances the successful pursuit of nobler game, or, I might say, game of any kind, as kiang are scarcely entitled to that designation. Curiosity is a marked trait of the kiang; so strongly developed in some instances that young individuals, as has happened to myself, will walk almost into the camp. These animals are free movers, going at a fine, springy trot, and the manner in which they traverse the most rocky ground, and this, too, at an elevation of between 13,000 and 16,000 feet, is marvellous; their hoofs must be like flint, and their lungs as strong as bellows.

PLATE XV

FIG. 1

FIG. 2

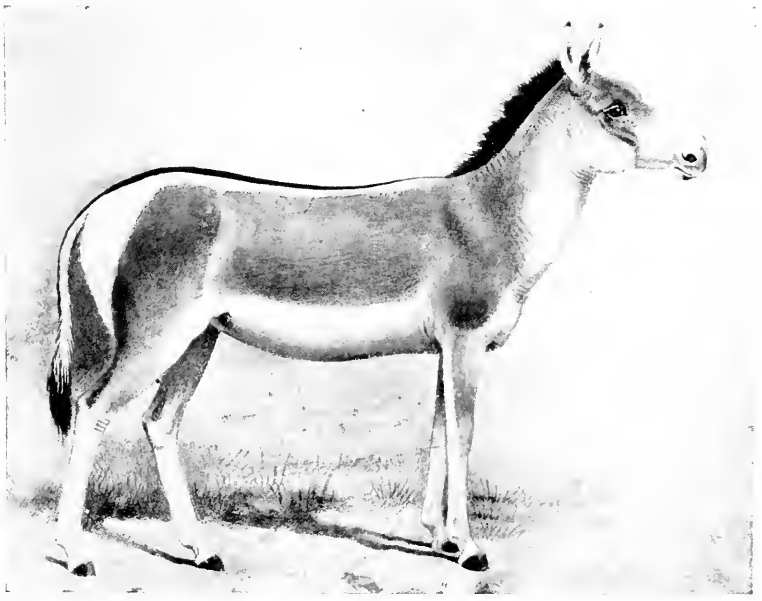


FIG. 1. The Kiang in summer coat.
FIG. 2. Kobdo Onager.

The kiang (pl. xv. fig. 1), which has a shoulder-height of about 13 hands, has been regarded as a local race of the chigetai, but it differs from that animal by the redder colour of the upper-parts, and the sharply-defined demarcation between this red area and the white of the muzzle, under-parts, buttocks, and limbs, thus giving a kind of skewbald appearance, which is most marked when the animal is in its short summer coat; the long and shaggy winter dress tending to obscure the difference between the dark and the light areas. The ears are characterised by the presence of a dark patch at the base, and another at the tip.

The kiang was first brought to scientific notice by Moorcroft, one of the early explorers of Kashmir and Ladak, whose travels, which contain an excellent account of the habits of the animal, were published in London in 1841. In Ladak the kiang is to be met with a few marches to the eastward of the city of Leh, and abounds in the great Chang-Chenmo plain and the arid country around the wonderful Pangong lake, the home of the chiru or Tibetan antelope, and formerly, the yak. Thence it extends northwards to the Kuen-Lun and eastwards into Tibet, where the limits of its range are still unknown. Scant as appears to be the nutriment in these barren countries, which in summer are scorched at midday by a burning sun, but become bitterly cold at night, it suffices to keep these

animals, as well as hares and marmots, in prime condition.

Unlike the African wild ass, which displays a holy horror of water, the kiang is very partial to that element, and never lives far away from some lake, river, or stream, into which, when occasion requires, it plunges without hesitation to take a longer or shorter swim, despite the icy coldness of Tibetan rivers.

In Mongolia the kiang is replaced by its cousin the chigetai (or dziggetai, as the name is spelt in German fashion), *E. hemionus*, which is a rather smaller and more uniformly coloured animal, of lighter make, and more rounded hoofs. The difference in general appearance is due in the first place to the less rufous tint of the darker areas in the summer coat, and secondly to the fact that this shades off almost imperceptibly into the dirty white of the under surface of the body and the paler fawn of the throat and limbs. Having the same narrow dorsal stripe and dark tips to the ears as the kiang, the chigetai lacks the dark patch at the base of the ears distinctive of the latter. Information is still required with regard to the extent of the range of the chigetai; but the animal is generally believed to be identical with the kulan of the Kirghiz Tatars.

Nearly allied to the chigetai is the species known in Persia as the ghor-khar, *i.e.* horse-ass,

and to the ancients as onager, *i.e.* wild ass (Greek *onos*, ass, and *agrios*, wild), which inhabits the deserts of Asia from Syria and Persia in the west to North-western India and Mongolia in the east. The onager (*Equus onager*), which is the wild ass of the Bible, is a rather smaller and paler-coloured animal than the chigetai, with nearly as well marked a contrast between the dark and light areas as in the kiang. Standing from 11 to 11½ hands at the shoulder, it has ears of much the same relative length as in the chigetai, but the hoofs narrower and more ass-like, this being especially the case with the front pair, which are scarcely wider than the hind ones. The profile of the face may be either nearly straight or markedly sinuous; the tail-tuft is of moderate size; and the dark dorsal stripe, which is always much wider than in either the kiang or the chigetai, stops in some cases short of the tail-tuft, and is flanked on either side, at least in the posterior half of its length, by a white or whitish band, joining the white on the buttocks and the backs of the thighs. In the summer coat the general colour of the upper-parts is usually some shade of pale reddish fawn or sandy, while the light areas, which vary from pure white to whitey brown, are much the same in extent as those of the kiang, but embrace more of the buttocks, from which they spread along the margins of the dorsal stripe, and in some cases

occupy more of the body and head. In winter, when it grows much longer and rougher, the coat becomes more or less decidedly grey, and in one race is distinctly mouse-grey, with sharply-defined white areas.

With such a wide geographical distribution, it is not surprising to find that the species is divisible into a number of more or less well-defined local races. One of the best-known of these is the Indian ghor-khar (*E. onager indicus*) of the desert districts of Sind, Cutch, Baluchistan, Eastern Persia, Afghanistan, and thence as far north as Bokhara, which is stated to attain a height of 11½ hands, and comes nearest to the chigetai. In Baluchistan the ghor-khar is most abundant near Mithankot, on the Punjab frontier. These districts lie to the west of the Indus; to the east of that river the chief districts frequented by this animal are Bikanir, Jeysulmere, and the saline tract known as the Rann of Cutch. With a straight facial profile, this ghor-khar has the general colour of the upper-parts sandy in summer, with the light band on each side of the dorsal stripe narrow, ill-defined, and whitey brown, and the white on the rump and thighs not pure. The broad dorsal stripe does not reach as far as the tail-tuft in the Indian representatives of this race, although it is stated to do so in Persian examples.

The second race, *E. o. castaneus* (pl. xv. fig. 2), is at

present known only by a single example, reported to have come from the Kirghis-Nor, in the Kobdo district of Western Mongolia.[1] It is characterised by the straight profile of the face, the rufous isabella-colour of the summer and the full greyish brown of the long winter coat, as well as by the large amount of white on the buttocks, and the distinctness of the pure white band on each side of the broad chocolate-coloured dorsal stripe, which reaches to the tail-tuft; the lateral white bands uniting with a broad white blaze on the buttocks, which is larger than in the other races. The short ears have more black at the tips than in the Indian race. In the typical or Persian ghor-khar (*E. o. typicus*), from Western Persia, to the southward of the Caspian, the white areas, as compared with those of the Indian race, have become so enlarged as to give the appearance of a white animal with three large fawn-coloured patches on each side. The general colour is silvery white; the dorsal stripe does not reach the tail-tuft; and the head, the sides of the neck, a small ill-defined band on the front of the shoulder, a larger quadrangular patch on the side of the body, and the middle of the hip, are isabella-colour, or pale sandy fawn. The facial profile is distinctly convex, and the ears are relatively small.

Owing to our imperfect acquaintance with the

[1] The locality is doubtful.

animals of Syria and Palestine, the fourth race (*E. o. hemippus*), the wild ass of Scripture, cannot yet be properly described. It inhabits the deserts between Bagdad and Palmyra, Mesopotamia, and Northern Arabia. Nearly related to the last, it appears to be reddish isabelline above, with the throat, under-parts, and a band on each side of the dorsal stripe silvery white, the dorsal stripe not reaching the root of the tail, which is moderately haired, and the profile of the skull sinuous.

The extremely light colour of the Persian race appears to be an adaptation to a purely desert existence, being paralleled in Africa by the mohr gazelle and the white oryx of the Sahara. Other adaptations to surroundings are shown by the thickness and length of the winter coat of the reputed Kobdo race, which is evidently an inhabitant of a country with a cold winter, as compared with that of the Indian race, which is quite short.

Like all large desert herbivorous animals, the ghor-khar is famed for its speed; this being so great that adults in good condition can neither be ridden down (unless, perchance by relays of horsemen) nor taken with greyhounds. Baluchis are indeed stated to have accomplished the former feat, but this was probably only when mares heavy in foal were the objects of pursuit. On the other hand, ghor-khar foals are commonly captured in summer in the Bikanir desert by parties of mounted

Baluchis, who relieve one another, and are thus enabled to continue the pursuit till the victims are completely exhausted.

Ghor-khars are mostly found on the fringe of desert plains, where they usually associate in small troops, although in Afghanistan herds containing sometimes a thousand head have been observed; such large herds being apparently composed of mares and foals, the old stallions collecting in smaller troops by themselves. In Baluchistan, as probably also in Persia, the foals are born in June, July, and August. On the plains the food of the onager consists of desert grasses, which are often in a parched and withered condition. In Baluchistan ghor-khars migrate to the hills in early summer when the plains are practically devoid of grass and water. Unlike the kiang, they are exceedingly shy and suspicious, and consequently difficult to approach within rifle-range.

In former days kulan and onagers appear to have ranged much further westward than is the case at the present day. It is stated, for instance, by the Russian naturalist Rytschkov[1] that in the eighteenth century kulan abounded on the eastern side of the Volga, and from time to time troops swam that river and made their appearance in the Waldinsel Steppe. Then, again, in spite of the difficulty of specifically distinguishing many of the

[1] See Nehring, *Über Tundren und Steppen*, p. 187.

fossil remains of the genus *Equus*, it is generally considered that during the Pleistocene period either the kulan or the onager (for it is impossible to distinguish between them in the fossil state) ranged into Central and Western Europe. Dr. Nehring,[1] indeed, believed that all the remains of small equines from France and Germany were referable to these animals; but Prof. M. Boule,[2] while admitting the occurrence of the onager in Western Europe, refers, as will be more fully noticed in the sequel, the majority of such remains to the ass.

[1] *Op. cit.*, p. 187.
[2] *Annales de Paléontologie*, vol. v. p. 132, 1910.

CHAPTER VIII

ZEBRAS AND QUAGGAS

AFRICA south of the northern tropic, that is to say, the Ethiopian Africa of naturalists, is the home of a group of more or less fully striped members of the horse-family, commonly known as zebras and quaggas. As to the derivation of the latter name there is no sort of doubt, quagga being the Dutch corruption of the Hottentot title—*qua-cha*—of one of the southern species, which is taken from the animal's cry. With regard to the origin of the name zebra, there is a difference of opinion. In one dictionary[1] it is stated, for instance, that the name comes from the Hebrew *tzĕbi*, meaning splendour or beauty, and connected with the verb *tzâbâ*, to shine, and the equivalent of the Arabic *zib*, beauty. An old writer, Job Ludolphus, in his *Historia Æthiopica*, published at Frankfort-on-Maine in 1681, states[2] that these animals are called zecora in Abyssinia and zebra on the Congo; while Colonel Hamilton Smith[3] shows that zebra "seems to be the Negro mutation of the Abyssinian

[1] Ogilvie's *Student's English Dictionary*, London, 1865.
[2] Book i. chap. x.
[3] *Naturalist's Library*, *Horses*, 2nd ed. p. 321.

zeuru of Lobo and the Galla zeora or zecora, according to Ludolphus."

To the Greeks and Romans zebras were known as *hippotigris*, a word meaning horse-tiger, although in Liddell and Scott's lexicon it is translated "large-tiger," from a mistaken idea that it is analogous in meaning to such words as horse-chestnut and horse-radish.

There is evidence that one at least of these hippotigres was exhibited in the Roman amphitheatre, by Caracalla;[1] and there is little doubt that this belonged to the species now known as Grévy's zebra, which is therefore not only the true hippotigris, but likewise the true zebra, although the latter designation is now applied to the South African species. In early days these zebras were considered royal gifts by the Abyssinian emperors, and it is stated by Mr. H. Scherren[2] that some were sent by King Assaghedus to the Governor of the Dutch East India Company at Batavia, by whom they were presented to the Emperor of Japan. "News of these facts was sent to Ludolphus by Emanuel Nawendorff, a native of Altenburg resident in Batavia. In return the Emperor sent 10,000 silver taels and thirty Japanese dresses, so that, as this correspondent of Ludolphus says, they were amply paid for. And the latter notes that these animals might be sent by sea if they would only bear the

[1] Hamilton Smith, *op. cit.*, pp. 320–21.
[2] *The Field*, vol. cv. p. 375, 1904.

FIG. 1

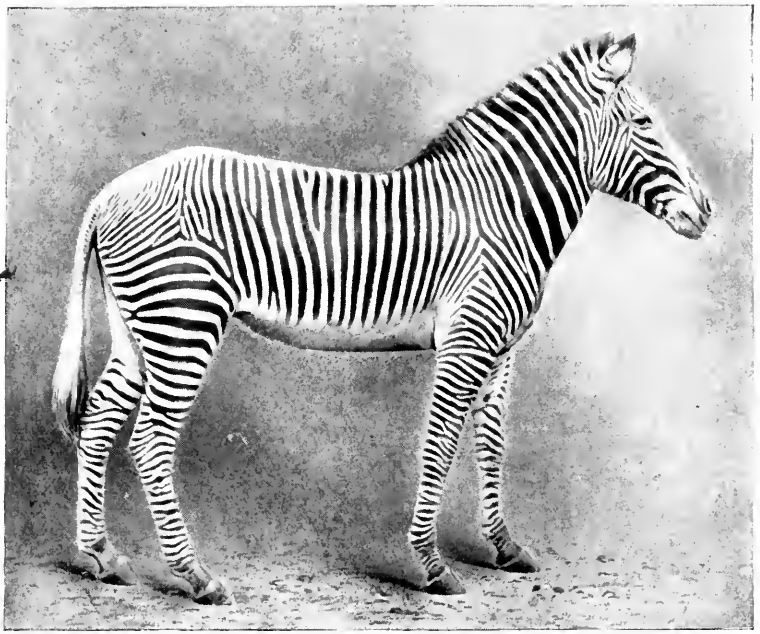


FIG. 2

FIG. 1. Grévy's Zebra.
FIG. 2. Head of Grévy's Zebra.

cold. Not only were these animals royal gifts at the time Ludolphus wrote, but before then at least one specimen had reached Europe alive. This statement rests on the authority of a French author, who saw the animal at Constantinople. He says that among other gifts brought by the Abyssinian envoy to the Grand Seigneur was an ass with a very beautiful skin, if indeed it were natural. This, however, he declined to vouch for, not having examined the animal. But he noted the more than ass-like size, the large head, long ears, and the regularity of the stripes 'of the breadth of a finger,' though he called the dark stripes chestnut-brown instead of black. . . . The Abyssinian envoy started with three zebras as gifts for the Turkish ruler; two, however, died by the way. These were flayed, and he brought the skins with him and presented them to the Grand Seigneur with the living specimen."

All the zebras and quaggas were separated from the genus *Equus* by Colonel Hamilton Smith to form a genus by themselves, for which he revived the classic name *Hippotigris*. There is no sufficient justification for this, as all the members of the group are closely allied to the other living *Equidæ;* and, what is of even more importance, exhibit considerable differences among themselves.

As already mentioned, all the members of the group are confined at the present day to Ethiopian Africa; and there is no sufficient evidence that

they ever ranged beyond it, although it may be quite possible that some of the earlier extinct representatives of the family were striped. It is true, indeed, that certain prehistoric sketches from various districts in France have been supposed to represent zebras, for which one writer has even gone so far as to propose the name *Equus maculatus*. Professor Boule[1] (in whose memoir fuller details on this point will be found) has, however, pointed out that the evidence is by no means conclusive, and the representations of these so-called zebras may be explained in three different ways. On one hypothesis the zebra-like markings are merely strokes employed by the artist to accentuate and beautify his sketches. A second theory supposes that all fossil horses, whether of the *caballus*, the zebra, or the extinct *stenonis* type, were striped. According to a third supposition it may be surmised that true zebras existed in Europe during the Pleistocene period, but that it has not been found possible to distinguish their teeth and bones from those of horses, onagers, and asses.

Professor Boule,[2] who is in favour of the first hypothesis, believes zebras to have taken origin from the extinct Steno's horse (*E. stenonis*) of the European Pliocene.

The aforesaid Grévy's zebra (*Equus grevyi*,

[1] *Annales de Paléontologie*, vol. v. p. 133, 1910.
[2] *Bull. Soc. Géol. de France*, ser. 3, vol. xxvii. p. 537, 1899.

pl. xvi.), of Abyssinia and Somaliland, is the largest and in some respects the most horse-like of the entire group, from the other members of which it differs markedly in the width and arrangement of the stripes, as it also does in the circumstance that the chestnuts on the inner sides of the fore-legs are as small as in the horse; while, as in that species, the mane extends on to the withers and the tail-tuft is large and full. The large, broad, and thickly-haired ears are quite different from those of all other members of the family, which are narrow and pointed. As regards the dark brown or black markings and the intervening light stripes on the body, head, and limbs, these are for the most part very narrow, widening out only on the lower jaw, neck, and the lower part of the thighs. On the flanks none of the stripes bend backwards and upwards to extend on to the hind-quarters, the upper portion of which is marked with vertical stripes arranged concentrically round the root of the tail. The dorsal stripe is very broad, especially near the middle of the back; and there are no transverse stripes on the under-parts. The stripes on the nose practically stop short of the dark nostril-patches, and the nose itself is greyish. It is thus evident that the stripes on the rump have their concavity directed upwards, whereas in the bontequagga the convexity is upwards.

A remarkable feature of this species is the

presence in the newly-born foal of a thick crest of long hairs, mostly rusty brown in colour, extending backwards from the withers along the back and tail to the terminal tuft of the latter, so as to form a continuation of the mane. If, as has been suggested, the colour-pattern of Grévy's zebra is the most primitive in the whole group, it may be that the spinal crest of the foal is likewise a remnant of an ancestral feature.

The large size of the ears and the narrowness of the stripes in this species are not improbably connected with a life spent partially in thick scrub; large ears being very commonly present in forest-dwelling animals, while narrow, vertically disposed stripes appear to be an adaptation for concealment in jungle.

Grévy's zebra, which stands about 13 hands in height, is divisible into two races. In the typical race, from the highlands of the Shoa district of Abyssinia, the dark stripes are black and the light ones white; but in the Somali race (*E. grevyi berberensis*), which is restricted to the western districts of Somaliland, the dark stripes are chocolate-brown, and the intervening bands ochery, so that the contrast between the two is much less strongly marked than in the Abyssinian animal. Indeed Mr. Drake-Brockman,[1] who incorrectly refers to it as a small zebra with broad stripes, states that the Somali

[1] *The Mammals of Somaliland*, London, 1910, p. 105.

race, when seen at a distance, looks like a black pony. He adds that "Grévy's zebra seems to prefer undulating, rocky, bush-country to any other. It is invariably seen in small troops of ten or twelve individuals. The older males are generally covered with scars, showing them to be very pugnacious. While hunting through the dense bush in localities where they are known to be, they are soon found, as they are very noisy." They are commoner in the Ogaden district of Western Somaliland, but of late years have been greatly reduced in numbers.

Colonel Swayne,[1] after mentioning that these zebras are found in Somaliland on stony country, covered with scattered bush, and intersected with ravines, at an elevation of about 2500 feet, states that those which he saw "were met with in small droves of about half-a-dozen, on low plateaux covered with scattered thorn-bush and *durr* grass, the soil being powdery, and red in colour, with an occasional outcrop of rocks. In such country they are easy to stalk, and I should never have fired at them for sport alone. I saw none in the open flats of the Webbe valley, and they never come nearly so far north as the open grass-plains of the Haud; Durhi, south of Fafan, being, I think, their northern limit. The young have longer coats, and the stripes are rather lighter brown, turning later on to a deep chocolate, which is nearly black in adult animals."

[1] *Seventeen Trips through Somaliland*, London, 1900, p. 321.

A very different animal to the last is the quagga (*Equus quagga*, pl. xvii. fig. 1), which formerly swarmed on the plains of Cape Colony, from which it has long since been swept away by the Boers, by whom it was shot at first as food for their Hottentot servants, and later on for the sake of its hide. Together with the remaining members of the striped group, the quagga has the chestnuts on the fore-legs larger than in Grévy's zebra, and the stripes broader. In this sub-group, whenever the hind-quarters are striped, the stripes are obliquely longitudinal, with the uppermost ones arising from the posterior region of the body, where their upper extremities are bent backwards towards the root of the tail in such a manner that there is no concentric arrangement round the latter. The muzzle is dark, and usually black, and the stripes on the nose are continuous with the dark patches round the nostrils. The ears are narrow, and always tipped with white.

In the quagga itself, which was confined to the plains south of the Orange River, the ears are comparatively small, the front hoofs are rather large, and a complete system of striping is retained only on the head, neck, and front half of the body, although some examples appear to have had spots farther back, indicating the remnants of stripes. Such stripes as remain on the body do not extend across the under surface to meet their fellows of the

FIG. 1

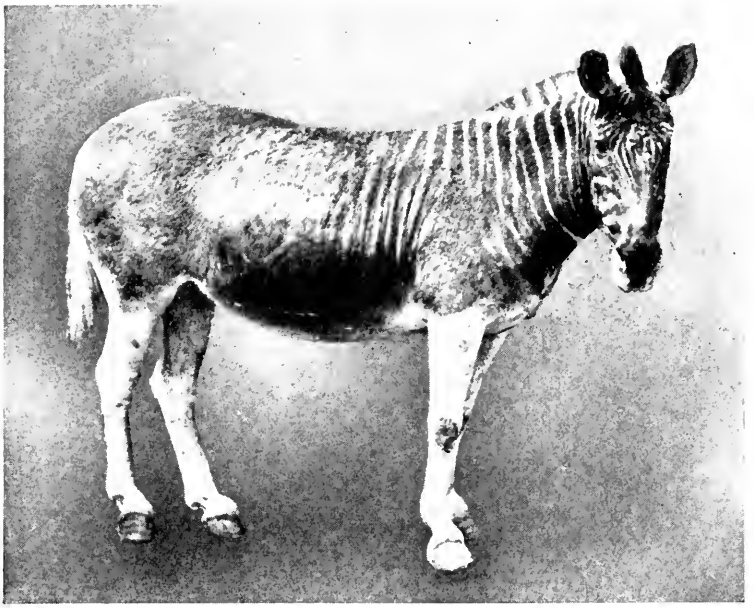


FIG. 2

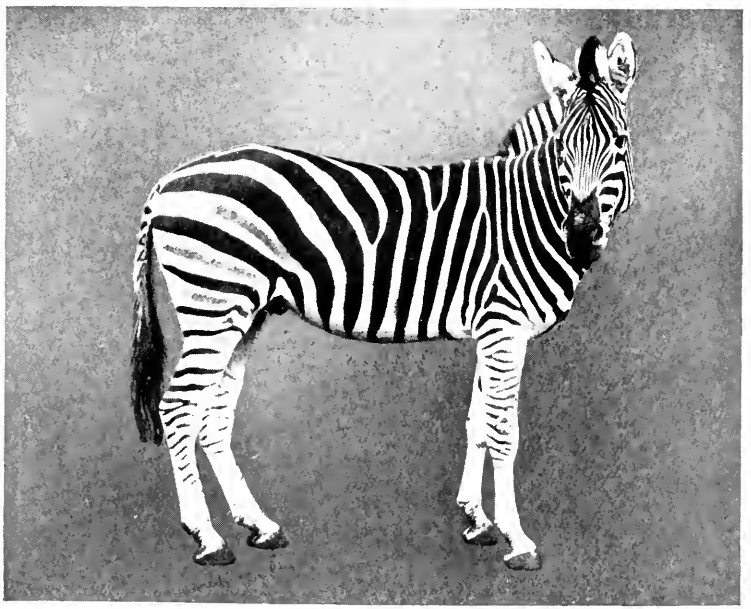


FIG. 1. The Quagga.
FIG. 2. The Matabili Bontequagga (Chapman's Zebra).

opposite side; the general ground-colour appears to have been yellowish red or chestnut, but the legs are much lighter, as is also the belly. The older African hunters, like Sir Cornwallis Harris, appear to have been convinced of the existence of more than one local form of quagga in Cape Colony and the adjacent districts; and the last survivor in captivity of these animals, which lived in the London Zoological Gardens from 1858 till 1864, whose portrait is given here, has been made the type of a separate race, under the name of *E. quagga greyi*. Names have also been proposed for other supposed races, but these it will be unnecessary to quote.[1]

When the Boers first trekked north of the Orange River they met, on the plains of what is now the British Bechuanaland Protectorate, an animal which they recognised as near akin to their familiar quagga, but distinguished by its brighter colouring and the extension of the striping on to the hind half of the body, including the buttocks. To this they gave the name bontequagga, signifying painted or striped quagga. When the true quagga disappeared from the country south of the Orange River and became more or less completely forgotten, the prefix *bonte* was dropped, and the northern animal took the name of its southern cousin. In the year 1825 a skin of the bontequagga brought to England by the traveller

[1] See Pocock, *Ann. Mag. Nat. Hist.*, ser. 7, vol. xiv. p. 313, 1904.

Burchell was described under the name of *Equus burchelli;* the English name of the animal then becoming Burchell's zebra, a title which it is now convenient to replace by the Boer name.

As Central and Eastern Africa was gradually opened up to European civilisation various other animals akin to the bontequagga were discovered, and in several instances received distinct names. The range of these extended in one direction as far north as Abyssinia, and in another as far west as Damaraland. As we proceed north from Bechuanaland, the home of the typical bontequagga, it will be found that the representatives of that animal gradually show the extension of dark stripes on to the legs, till in the most northern forms these are striped down to the hoof, and likewise the disappearance of what are known as shadow-stripes, that is to say, faint tawny streaks running down the middle lines of the light stripes. In spite of the great difference in these respects between the extreme northern and southern forms, it is quite evident that all of them are nothing more than local races of the bontequagga. Indeed, they have been regarded as nothing more than local races of the quagga, from which, however, it is convenient to separate all its relatives north of the Orange River, in which the hind half of the body is striped, as a distinct species.

In regard to the presence or absence of striping

on the legs, it is curious to note that the bontequagga presents a condition precisely the reverse of that which occurs in the case of the giraffe; the southern races of the former having white, unstriped legs, whereas it is the northern forms of the latter in which the lower portion of the limbs is white and unspotted.

The typical bontequagga,[1] now nearly or entirely extinct in the wild state, stands about 12 hands at the shoulder, and has the ground-colour orange, and the shadow-stripes on the hind-quarters strongly marked, and narrower than the main stripes, which are themselves broader than the light interspaces containing the shadow-stripes. The hind-quarters have only a few short stripes below the long stripe running to the root of the tail; the body-stripes stop short on the sides of the under-parts, so as to be widely separated from the longitudinal ventral stripe; and, with the occasional exception of a few on the knees and hocks, the legs are devoid of stripes, as are usually the sides of the tail. Nearly allied is the Damara *E. b. antiquorum*, in which stripes occur on the legs above the knees and hocks, but none, or at most a few, below them. Zululand is the home of a race, *E. b. wahlbergi*, in which, like all those which follow, the body-stripes meet the ventral stripe inferiorly, while the legs are more or less fully

[1] See Pocock, *Proc. Zool. Soc.* London, 1909, p. 415, fig. 48.

striped. In this particular race[1] the shadow-stripes on the hind-quarters are strongly developed, and not much narrower than the main stripes, which are narrower than the intervening spaces; and the fetlocks and pasterns are devoid of stripes or spots. In the Matabili *E. b. chapmani* (pl. xvii. fig. 2) the shadow-stripes have become faint and narrow, the legs are barred to the hoofs, but the stripes on their lower portions tend to break up into spots, and the inferior part of the pasterns is not wholly black. This race inhabits the country between Damaraland and Matabililand. The last representative of the species in which shadow-stripes are distinctly developed is the Mashona *E. b. selousi*, which differs from the last in that the barring of the legs is complete down to the hoofs; the pasterns being striped on both sides, and their lower part, owing to the fusion of several stripes, wholly black. The sides of the tail are also striped.

On the north side of the Zambesi the species is first represented by *E. c. boehmi* (pl. xviii. fig. 1), typically from the plains around Kilimanjaro, which appears to connect *E. b. selousi*[2] with the more northern races, retaining slight traces of shadow-stripes, which in many cases are visible only on the hind-quarters, and having the bars on the pasterns distinct from one another.

[1] See Pocock, *Proc. Zool. Soc.* London, 1909, p. 416, fig. 49.

[2] Mr. J. Roux, *Révue Suisse de Zoologie*, vol. xviii. p. 924, 1910, considers *selousi* inseparable from *boehmi*.

Closely allied to the Kilimanjaro race, and perhaps really intergrading with it, is the bontequagga of British East Africa, which has been named *E. b. granti* (pl. xviii. fig. 2), and may be known in English as the Masai race.

In this race, as well as in the nearly allied *E. b. crawshayi* of Southern Nyasaland (British Central Africa) and in *E. b. jallæ* of Southern Abyssinia, the shadow-stripes have completely vanished, and the principal stripes on the hind-quarters are at least equal in width to the intervening spaces, which are white. In *crawshayi* the dark stripes are relatively narrow and of a full black, the nostril-patches are yellowish brown, or tan-colour, and the pasterns are marked like those of *selousi*. On the other hand, in the British East African *granti*, the stripes are broader and in some cases less completely black, and the bars on the pasterns are fused into a continuous black band. In the South Abyssinian *E. b. jallæ* there is said to be a difference in the number of the stripes, as compared with *granti*, but the difference is considered by Mr. Roux[1] to be merely individual.

Apparently related to *crawshayi* is a bontequagga from North-eastern Rhodesia (*E. b. annectans*), characterised by the great excess in width of the dark over the light stripes. In this place it may be mentioned that some bontequaggas from British

[1] *Op. cit.*, p. 924.

East Africa, which appear to represent a variety of *boehmi*, show a kind of "gridiron-pattern" on the upper surface of the hind-quarters, which at first sight seems to recall the more distinct gridiron of the typical zebra. In these East African bontequaggas the middle spinal stripe is, however, completely isolated throughout its length, and the semblance of a gridiron-pattern is due to the partial breaking up and fusion of the uppermost pair of long oblique stripes traversing the quarters.

In certain bontequaggas from the Gwasengishu plateau of British East Africa, the forelock is entirely wanting, and the mane, except for a small tuft in advance of the withers, is reduced to the same condition as in a hog-maned polo-pony, thereby presenting a peculiar appearance, quite different from that of an ordinary bontequagga or zebra. The backs of the ears are almost wholly white. A similar peculiarity is observable in a bontequagga skin from the Lake Mweru district in the British Museum, and, according to Mr. Selous, the same feature characterises all the bontequaggas of the Gwasengishu district, at any rate during the season of the year when they came under his observation. These belong to the Masai race (*granti*), which was originally described from the Athi plains of East Africa. Some at least of the Athi zebras appear to have very little mane, but their ears have dark markings. On the other hand, a specimen

FIG. 1

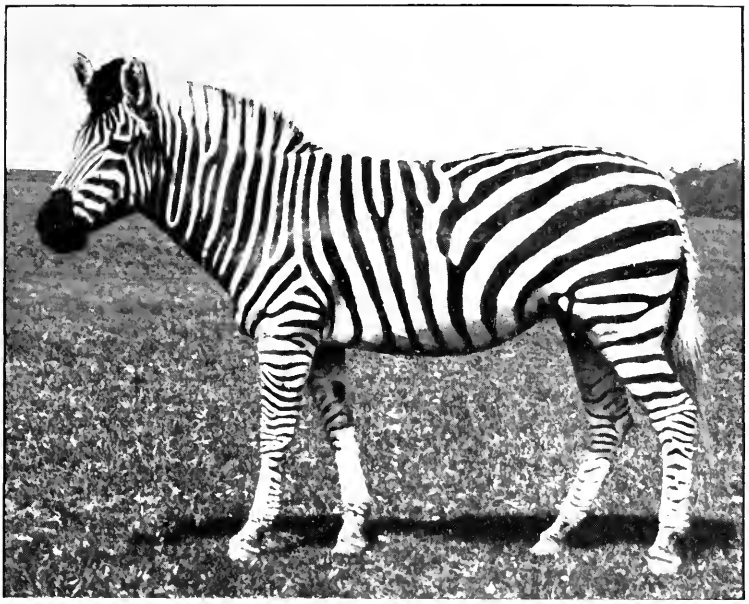


FIG. 2

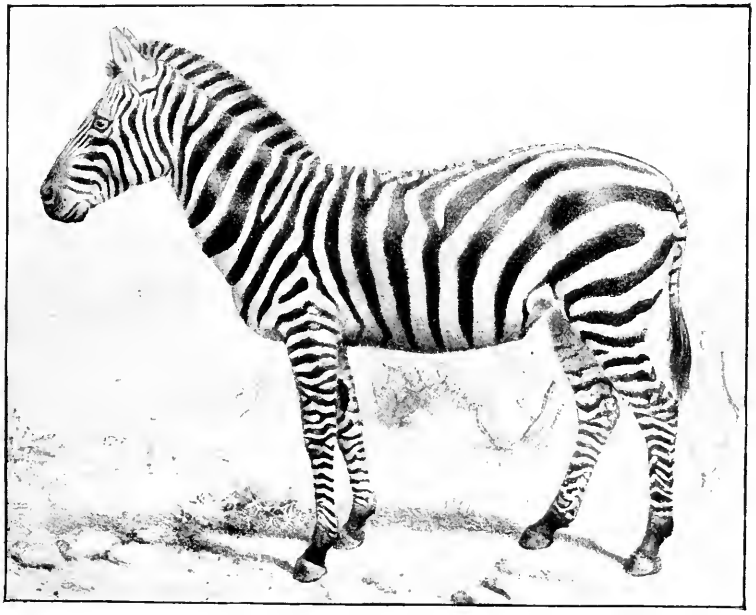


FIG. 1. Kilimanjaro Bontequagga
FIG. 2. Masai Bontequagga.

figured by Dr. Sclater in the Zoological Society's *Proceedings* for 1911 (reproduced in pl. xviii. fig. 2) is represented with a full and bushy mane and forelock. In this respect it resembles the closely-allied Kilimanjaro race. Whether the absence of the mane and forelock in the Gwasengishu individuals is a seasonal or a permanent feature can, of course, be definitely determined only by observations made at different times or year. The fact that no complete seasonal shedding and loss of the mane has been recorded in the case of specimens of the more southern races of bontequagga kept in menageries renders it almost certain that the feature is permanent. Assuming this to be the case, it is noteworthy that the Masai bontequagga is one of the most northern representatives of its kind, and that within the limits of the range of that race the tendency to the loss of mane and the acquisition of almost completely white backs to the ears attains its full development only in the more northern districts. In the domesticated horse it is ascertained that no seasonal shedding of the hairs of the mane and tail takes place, and that for the most part these continue to grow throughout life.

In 1911 a curious "sport" was recorded among a few of the Masai bontequaggas inhabiting the Nakura district of British East Africa. These bontequaggas, which have unfortunately received

a distinct name (*goldfinchi*[1]), are characterised by the presence of a fawn-coloured unstriped area immediately in front of the large oblique stripes on the quarters. As only two or three individuals showing this peculiarity are seen among the herds of ordinary *granti*, it is quite clear that the feature, as I have pointed out in *Nature*,[2] is merely a sport. A nearly white example of Grant's or one of the allied races is exhibited in the Tring Museum, and there is an albino Grévy's zebra in the Natural History Museum.

Much confusion has arisen from the description of a so-called Ward's zebra, which Mr. R. I. Pocock[3] has shown to be almost certainly based on a hybrid between the typical zebra and one of the bontequaggas, probably *chapmani*.

Quaggas and bontequaggas are essentially animals of the plains, on which they congregated in large herds, frequently associating with ostriches and gnus; the species of the latter group herding with the true quagga being the white-tailed gnu, while to the north of the Orange River its place was taken by the brindled gnu. In 1837 Sir Cornwallis Harris encountered enormous herds of quaggas on the plains south of the Vaal River, but even at that date they seem to have become scarce in Cape Colony. As to the exact date of their

[1] Ridgeway, *Nature*, vol. lxxxvi. p. 245, 1911.
[2] *Ibid.*, p. 281.
[3] *The Field*, vol. cxiv. p. 389, 1909.

extermination, there is some uncertainty, but Mr. H. A. Bryden believes that they lingered in the more remote districts of Cape Colony till some time between 1865 and 1870, and a little later in the Orange River Colony. Their range originally included Cape Colony, the Orange River Colony, and part of Griqualand West.

Of the beauty of the southern bontequagga, or Burchell's zebra, on the veldt to the north of the Orange River, Mr. Bryden[1] writes in the following enthusiastic terms :—

"With its clean, sleek coat, shining in the sunlight like a well-groomed horse's, its flowing tail, rich colouring, graceful mane, perfectly hogged by nature, and beautiful head, it forms a noble picture, framed in its usual setting of grassy plain, or park-like, open bush-veldt. Often when in pursuit, at a signal from the big stallion bringing up the rear, I have seen the flying troop suddenly wheel round in line, and stand with heads up, ears pricked, and distended nostrils, to stare for a full half-minute at their disturbers. Then, with curvets, prancings, and whirling tails, away again they scour, perfect types of feral beauty. Not seldom you may see them with their constant allies the brindled gnus; with perhaps a troop of ostriches to fill up the company."

This association of three totally different kinds

[1] *Nature and Sport in South Africa*, London, 1897, p. 177.

of animals may, it has been suggested, be of mutual advantage to each; for ostriches, by reason of their tall stature and elevated heads, would be enabled to detect the advance of an enemy by sight long before it was visible to the other members of the trio, while the latter would be warned by scent much sooner than the ostriches. When the members of one of the species started to run, the others would be pretty sure to follow suit. The quagga was reputed to be possessed of great courage, and at the time of its abundance is stated to have been kept on the Boer farms in Cape Colony for the purpose of driving off hyænas and wild dogs.

Both quaggas and bontequaggas have been broken to harness and driven; but the latter, at any rate, have been said to be deficient in staying power. On the other hand, in the issue of the *Agricultural Journal* of the Union of South Africa for August 1911 it is stated that in Zululand the evidence afforded by a team of eight bontequaggas, or zebras, as they are called in the report, leads to the conclusion that these animals are of great value for transport purposes on account of their immunity to disease. "They respond quickly to the whip when pulling, they are not given to plunging, but crouch down and pull steadily; they keep their condition without corn-feeding, and they appear more intelligent than mules or donkeys. Against

those qualities may be quoted the lack of stamina, which was disclosed when working in the sandy veldt; but this, I think, was mainly due to a want of corn-feeding, for it seems barely possible for it to be a characteristic failing of the species, as they are of muscular build, although light-boned."

In this place it will be convenient to refer to modern views with regard to the object of the peculiar type of colouring presented by quaggas, bontequaggas, and zebras. In all the fully-striped members of the group it is commonly believed by naturalists that the general effect of this type of colouring is to render the animal in which it occurs inconspicuous at a distance on open places, at close quarters in moonlight or at dusk, and amid bush-jungle. Such effects are due in part to the alternate dark and light stripes harmonising with the shafts and streaks of sunlit falling on foliage, and in part to the stripes on the body and limbs breaking up the general hard outline of the animal into a more or less indistinct, soft greyish blur. This, however, is not all, for it has been shown by Mr. R. I. Pocock[1] that the arrangement of the striping in these animals is specially designed to give the utmost intensity to this breaking-up effect. As is well shown in some of the accompanying illustrations, the arrangement of the striping in the more northerly races of the bontequagga divides

[1] *Proc. Zool. Soc. London*, 1909, p. 418.

the body into two distinct areas ; the stripes on the front half taking a more or less nearly vertical direction, while those on the quarters display a general longitudinal trend. The optical effect of this is to divide the animal into two distinct objects when viewed from a certain distance, so that the complete horse-outline becomes more or less completely obscured and obliterated. This effect is enhanced by the stripes at the base of the neck being wider than those on the shoulder, to which they are inclined at an angle when the head is carried in the usual pose. A further effect in breaking up the outline of the animal is produced by the circumstance that the stripes on the face are narrower than those on the neck and likewise somewhat different in direction, and also by the transverse direction of the bars on the legs. The head and body of a bontequagga are thus broken up by the nature and direction of the stripes into four more or less distinct and separate areas, namely the head, the neck, and the fore and the hind parts of the trunk. At a distance less than that at which the whole of the stripes melt into a confused grey blur, the general effect is to render the animal much less conspicuous than would be the case if the stripes were of the same width throughout, and took the same direction on all parts of the skin.

There is yet another point in connection with

the colour-pattern of the animals under consideration. In the zebra, Grévy's zebra, and the more northern races of the bontequagga the legs are striped right down to the hoofs, while in the last-mentioned animals the stripes extend downwards to meet the longitudinal belly-stripes. Now all these animals inhabit more or less broken or bush-covered country. On the other hand, the quagga and the typical southern race of the bontequagga inhabited the open South African plains, and in these the legs are lighter coloured than the body, while in some forms of the quagga and in the southern bontequaggas the whole of the under-parts and much of the buttocks are likewise white. Moreover, in the latter the black stripes of the northern bontequaggas are toned down to brown and faint orange shadow-stripes intercalated. Here, in fact, a totally different kind of colour-protection comes into play; namely, one common to a large number of herbivorous animals living on open plains, and already referred to in connection with the kiang and onager. In this type of colouring the under surface of the body and the limbs are conspicuously lighter (often white) than the upper parts, so that when the animal is standing in bright sunlight the light colouring of the lower surface completely counteracts the effect of the dark shade cast by the body, and thus produces more or less complete invisibility. Much the same effect is

produced when the animal is lying down, by the white legs being tucked away along the sides of the white belly. The absence of striping on the hind half of the body and limbs of the quagga and southern bontequagga thus appears to be an acquired character developed for the special purpose of rendering these animals inconspicuous on the sun-scorched and trackless veldt and karru which form their home.

On the other hand, many naturalist-sportsmen like Mr. Selous, Captain Stigand, and Mr. Roosevelt, who have seen zebras and bontequaggas in their native haunts, emphatically refuse to believe in the theory of the protective nature of their colouring. Mr. Roosevelt,[1] for instance, expresses himself as follows on this subject :—

"The zebra has also, very absurdly, been taken as an example of 'concealing coloration.' . . . As a matter of fact, it is not concealing, it is highly advertising, when close at hand; but when over three or four hundred yards off the black and white stripes merge together, and the coat becomes monocoloured, but catches the sunlight in such shape as still to render the bearer conspicuous. The narrow stripes of the big Grévy's zebra fade together at a shorter distance than is the case with the broader stripes of the smaller zebra; the broad

[1] "Revealing and Concealing Coloration of Birds and Mammals," *Bull. Amer. Mus. Nat. Hist.*, vol. xxx. p. 191, 1911.

bands on the rump of the latter can be seen at a great distance. The zebra [*i.e.* bontequagga] is purely a beast of the open plains; it never seeks to conceal itself, but trusts always to seeing its foes. When under or among thin-leaved, scattered thorn-trees it is still usually conspicuous; although now and then a peculiar light and shadow effect may conceal it."

After quoting evidence from Captain Stigand[1] to much the same effect, Mr. Roosevelt proceeds to express his disbelief in the protective value of the white bellies of kiangs, onagers, and wild asses; attributing this to some general cause, like that which has led to the under surface of the leaves of so many plants being lighter coloured than the upper ones.

The "personal equation" has, of course, something to do with the difference of opinion on these facts; but whatever may be the real truth with regard to some of the disputed points, it is certain that when a zebra enters covert, it becomes, owing to its colouring, indistinguishable.

In 1899 a zebra or bontequagga inhabiting the mountainous country opposite Teti, on the north bank of the lower part of the Zambesi, was described as a distinct species by Messrs. Prazák and Trouessart in the *Bulletin du Muséum d'Histoire Naturelle, Paris*, vol. v. p. 350, as *Equus foai*. From

[1] *The Game of British East Africa*, London, 1909.

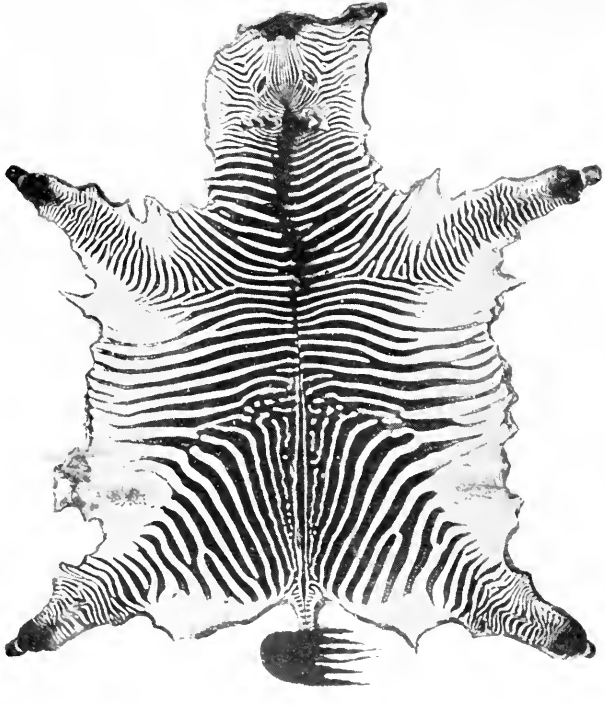
the races of the bontequagga this zebra (pl. xix. fig. 1) is distinguished by the larger number of main stripes on the body and hind-quarters, and also by the absence of any backward bending (except in the last of the series) of the stripes on the middle of the body (about ten in number) as they approach the dorsal stripe, to which they run approximately at right angles. In this respect Foa's zebra approximates to the zebra and Grévy's zebra, from both of which it differs by the stripes on the hind-quarters adjacent to the dorsal stripe running parallel with the latter in the direction of the tail, as in the bontequagga, instead of at right angles. Consequently, the gridiron-pattern of the true zebra, and the concentric stripe arrangement of Grévy's zebra in this region are wanting. In the general build, as well as in the shape of the head and ears, Foa's zebra is nearer to the bontequagga than to either of the other two species; this being borne out by the fact that the body-stripes meet the stripe traversing the middle line of the under surface. The legs are barred to the fetlocks, and the pasterns black. By Mr. Pocock[1] Foa's zebra is regarded as related to the Nyasa bontequagga, *E. b. crawshayi*. The marked difference between the markings of Foa's zebra and the Masai bontequagga is well exhibited in plate xix.

Although, as mentioned above, the title of typical

[1] *Harmsworth Natural History*, p. 789.

PLATE XIX

FIG. 1



Skin of Foa's Zebra.

FIG. 2

Skin of Kilimanjaro Bontequagga.

or true zebra properly belongs to Grévy's zebra of Abyssinia and Somaliland, it is applied by naturalists to the species inhabiting the mountains of Cape Colony, the *Equus zebra* of Linnæus and the wilde-paard (= wild horse) of the Boers. From the other members of the striped group this species (pl. xx. fig. 1) is distinguishable at a glance by its more ass-like appearance—especially the relatively great length of the narrow ears—and the full development of a gridiron-like pattern of transverse stripes on the hind-quarters above the tail. The stripes are white on a black ground. In addition to these features, the species is characterised by the hairs on the middle of the back, from the withers to the rump, being directed forwards instead of backwards. The tail-tuft is less developed than in other species, and the hoofs are narrower. With the exception of those of the hind-quarters, which on the sides are very broad and separated by light intervals of approximately similar width, the transverse stripes on the body are narrow and closely set, and all of them stop short of the middle line of the belly, so as to leave a white space on each side of the longitudinal ventral stripe. The corresponding dorsal stripe is very narrow, and connected with the transverse stripes, most of which run nearly at right angles to this line, although the last two, which are much broader than the rest, are bent sharply backwards, so as

to cause the uppermost one on each side to form the lateral border of the aforesaid gridiron. Although some of the northern races of the bontequagga show traces of this gridiron, it is never so strongly developed as in the present species. All the limbs are barred down to the hoofs, and the chestnuts on the front pair are larger than in any other existing member of the horse family. The throat is also peculiar in having a small dewlap, and there is a considerable amount of tan-colour on the muzzle. In height the zebra apparently stands about 11½ hands; although many of the old writers put the stature considerably higher, as they do in the case of the bontequagga.

Although the zebra is essentially a mountain animal, inhabiting the very summits of the ranges of Cape Colony, while the quagga was a denizen of the surrounding plains, this difference in habits was unknown to Linnæus, who regarded the latter as the female of the former, and therefore did not give it a distinct scientific name. Formerly the zebra, or mountain zebra, as it is sometimes called, seems to have inhabited all the mountain ranges of Cape Colony, where its former presence is indicated by such names as Paarde Berg, Paarde Kraal, and Paarde Fontein; and about the year 1892 a few herds survived, under Government protection, on the Zwartberg, Sneeuberg, and Winterhoeck ranges, and some still remain in a wild state in the Cradock

district. Others, in a half-domesticated state, run on some of the Boer farms, where, as mentioned later, they occasionally breed with the asses.

The zebra is an adept in getting over rough and rocky ground; the course of the herds being stopped only by absolutely unclimbable precipices. In other respects its habits seem to be very similar to those of its kindred, although there seems to be no evidence of its habitually consorting with animals of totally distinct kinds. The following picturesque description of an encounter with a troop of zebras is given by Mr. H. Bryden:[1]—

"In company with a Kafir hunter I came suddenly upon a small troop guarded by a sentinel —an old stallion. They were a magnificent spectacle, far up in a precipitous piece of savage mountain scenery. We had a long look at them at two hundred and fifty yards' distance, and then suddenly the stallion got our wind or espied us, a wild neigh of alarm was given, and the troop, with tails whisking, tore headlong over the mountain and quickly disappeared."

Whither the *daow* or *dauw* of the Hottentots was the zebra or the quagga seems doubtful, and the name may have been applied to both animals. By some writers it is given as the designation of the southern race of the bontequagga.

The range of the zebra is, however, by no

[1] *Nature and Sport in South Africa*, p. 164.

means restricted to the mountains of Cape Colony, for in 1898 Professor P. Matschie[1] described, under the name of *Hippotigris hartmannæ*, a zebra from the Kaokofeld, between the Hoanib and Unilab rivers, in Damaraland, which is certainly nothing more than a local race of the present species. It is true that in the original description the Damara zebra was stated to have fewer stripes on the forehead than the Cape animal, but this feature has been subsequently found to be inconstant, as has likewise the presence of a pale band on the thigh.[2] On the other hand, the Damara zebra seems to be characterised by the chocolate-colour of the dark stripes, and by the light intervals being tawny instead of white. The Damara zebra may, therefore, be known as *E. zebra hartmannæ*.

Two years after the publication of the description of the Damara race Mr. O. Thomas[3] proposed the name of *Equus penricei* for a zebra typified by an animal shot by Mr. Penrice at Providencia, about seventy kilometres to the north-east of Mossamedes, in Southern Angola. That this animal is nothing more than a local race of *E. zebra* seems certain, and at present there is no sufficient evidence of its right to distinction from the race described by Professor Matschie.

[1] *Sitz. Ber. Ges. Naturfor. Freunde*, Berlin, 1898, p. 175.

[2] See W. L. Sclater, *Fauna of S. Africa—Mammals*, vol. i. p. 286.

[3] *Ann. Mag. Nat. History*, ser. 7, vol. vi. p. 465, 1900.

FIG. 1

FIG. 2

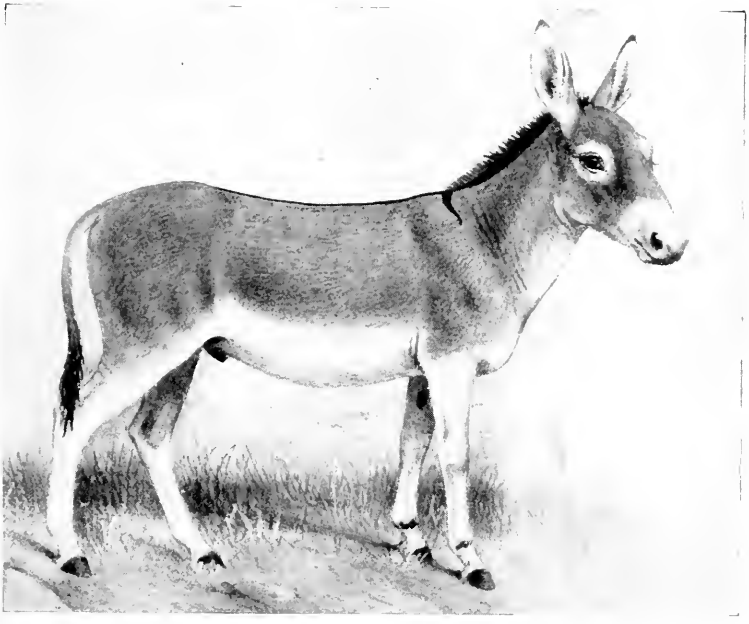


FIG. 1. The Zebra.
FIG. 2. Nubian Wild Ass.

CHAPTER IX

THE ASS

ALTHOUGH at first sight there does not seem to be much connection between *onos*, the Greek, and *asinus*, the Latin name of the ass, yet both are believed to be derived from a Semitic word akin to *athôn*, the Hebrew term for she-ass. The mode of derivation of the Greek word, which may have been originally *asnos* or *osnos*, is supposed to have taken place by the elimination of the *s*, the equivalent of the Hebrew dental *th*, before the *n*.[1] The Anglo-Saxon *assa* and the German *esel* are, of course, modifications of the same word. On the other hand, the Persian *khar* would seem to be from a totally different root; this word, as already mentioned, occurs in *ghor-khar*, the Persian name of the onager, and, like the latter, signifying wild ass, and also in *khargush* (literally asses' ears), the Persian and Hindustani term for the hare. "Donkey," it may be added, is a late nickname for the ass, said to be derived from its colour, and supposed to be the equivalent of *dun*, with the addition of the diminutive *kin*. If this be so, the names donkey and dunlin

[1] See Heyn and Stallybrass, *Wanderings of Plants and Animals*, London, 1835, p. 460.

(the well-known shore-bird) are identical in origin, but it may be pointed out that the colour of the ass is grey, and not dun.

From the reputed Eastern origin of the West European names of the ass, it has been very generally considered that the animal itself, in its domesticated condition, is likewise of Eastern origin, and that it reached Europe by way of Asia Minor and Syria, although its original home may have been North-western Africa, where true wild asses are alone found at the present day.[1] Without denying that such a view may be true, it has to be borne in mind that Professor Marcellin Boule[2] is convinced that certain remains of small and slenderly built equines from the cavern and other superficial deposits of France and Italy pertain to the ass, as distinct from the onager, whose remains are also found in the same formations. How he distinguishes the ass from the onager on the evidence of fossil bones and teeth alone is not clearly stated; but if his conclusions be trustworthy, there would seem to be a possibility of the first domestication of the ass having taken place in Southern Europe. On the other hand, it appears that in Homeric times the ass had not become a common domesticated animal, as it is mentioned but once in the Iliad, and then in a simile believed to have been inserted by a later

[1] See Heyn and Stallybrass, *op. cit.*, p. 10.
[2] *Annales de Paléontologie*, vol. v. p. 116, 1910.

poet. In the Odyssey the ass is not referred to at all, neither does its name occur in the works of Hesiod.

Nevertheless, even if domesticated asses were introduced into Europe from the East, it is probable that the wild animal was first tamed in the Mediterranean countries, as we have no evidence that it ever existed to the eastward of the Red Sea. If this view be correct, asses must have reached India from the westward; this being the opinion of Darwin,[1] who unhesitatingly regards all the domesticated breeds as the descendants of the North African wild animal.

Although Linnæus based his *Equus asinus* on the domesticated ass of Europe, we cannot take any particular breed or strain as the actual type of the species, since Sweden has none of its own. As a matter of fact, the ass is essentially a southern animal, partial to hot and dry countries, and exceedingly averse to enter water. Indeed, it has been stated that "the ass, and with it its name, accompanied the progress of the culture of the vine and olive to the north, not crossing the limits of that culture. In proportion as the ure-ox, the bison, and the elk died out, the long-eared foreign beast became domesticated in Gaul, receiving various names, and living in the customs, jokes, proverbs, and fables of the people. Germany, however, proved too cold for the animal."[2]

[1] *Animals and Plants under Domestication*, vol. i. p. 65.

[2] Heyn and Stallybrass, *op. cit.*, p. 111.

As already mentioned, the ass is nearly related to the true zebra of Southern and South-western Africa, with which it agrees in general form, in the shape of the head, in the length of the ears, and in the narrowness of the hoofs. With the exception that one (or occasionally a pair) is very generally retained on the shoulders, and that barring frequently persists on the legs, the ass has, however, lost the stripes of its southern cousin, evidently in adaptation to a life on desert plains. In the frequent retention of barring on the legs the species presents a remarkable contrast to the quagga and the southern races of the bontequagga, whose colouring has also been modified in accordance with the requirements of a very similar mode of life, but in which the leg-barring has been the first of the dark markings to disappear.

In contrast to the chestnut or sandy tint characteristic of the Asiatic kiang and onager, the general colour of the wild ass is grey ; but this is most marked in summer, when the coat is clear French grey, whereas in winter, when it is also slightly longer, it becomes sandy grey. The muzzle is white, with the lips ashy, and a ring round each eye, the under-parts, and generally the limbs, are likewise white. The mane and tail-tuft are blackish, as are also the dorsal stripe, the shoulder-stripe, and the barrings on the legs, when these are retained. In domesticated breeds the colour ranges from

black through grey to white; but in all cases the belly, like the muzzle, remains white, showing how deeply-rooted a feature is this element in the desert type of colouring.

Such European domesticated asses as retain some approximation to the colouring of their wild relatives have the legs, which are often barred with black, in most cases scarcely, if at all, lighter than the body. They are also characterised by the presence in nearly every case of a large brown or blackish patch at the base of the outer surface of the ear; these patches being also present in the domesticated asses of Socotra, which have reverted to a wild state, and otherwise closely resemble their truly wild relatives.

In the ordinary wild asses of Africa this basal dark patch is represented merely by a faint shading, the outer surface of the ear being distinctly brown or black only at the tip; moreover, the legs are white, with or without dark bars. This leads Mr. R. I. Pocock[1] to conclude that domesticated asses are descended from another race of the species in which the aforesaid features were developed. Whether such an animal survives at the present day is doubtful; but it is suggested that in former days, at any rate, it may have inhabited parts of Nubia, extending considerably to the northward of

[1] *Ann. Mag. Nat. Hist.*, ser. 8, vol. iv. p. 523, 1909.

the fifth cataract of the Nile, where wild asses are now unknown.

The African wild asses of the present day, which stand about twelve hands at the shoulder, are divided into races according to their markings. The Nubian race (*E. asinus africanus*, pl. xx. fig. 2), which inhabits the country on both sides of the Atbara river, in the Eastern Sudan, to the south of Nubia proper, has a distinct shoulder-stripe, but no dark markings on the limbs, with the exception of a patch on the fetlocks. On the other hand, the Somali race (*E. a. somaliensis*) has more or less completely lost the dorsal and shoulder stripes, but has the legs fully barred. There appears to be also a third type, *E. a. tæniopus*, in which dorsal and shoulder stripes are combined with full barring of the legs, but whether it has a habitat of its own, and is thus entitled to rank as a definite local race, has not yet been ascertained.

In general character wild asses resemble the less altered domesticated breeds, although differing by their more slender limbs and greatly superior speed. Both have the same loud, unmelodious bray, which is uttered by both sexes, and is said to be nearly paralleled by the cry of Grévy's zebra. Both display the same aversion to enter water; and the domesticated breeds have doubtless inherited their capacity for existing on the poorest and driest fodder from their wild ancestor, whose subsistence consists

of the hard, dry grasses growing in semi-desert districts of North-eastern Africa.

In the domesticated condition asses are now spread over a very large part of the warmer regions of the Old World, including Southern and Central Europe, the whole of Eastern and Southern Asia, and Northern and Eastern Africa; while they are also common in many parts of South America, where some of them have run wild. Asses that have reverted to the wild state are also found in the island of Socotra; and they are also stated to have formerly existed in that condition in Sardinia and some of the islands of the Grecian Archipelago.

The feral asses of Socotra, which are of the Nubian type, although with the above-mentioned blackish patch at the base of the backs of the ears, closely resemble their wild progenitors, being all coloured alike. The same is the case with many of the less altered domesticated breeds, notably the "gadas" of India. On the other hand, there are many breeds which depart markedly from the wild ancestral type in the matter of colour, and in some cases also in their superiority of stature, or in the length and thickness of the winter coat. The colour variation is, however, much less marked than in the case of the horse; bay, chestnut, and true dun being almost unknown.

Throughout the East the ass is much more extensively used for riding and in agricultural operations

than is the case in Europe; and many countries have special breeds adapted for particular kinds of work. It is stated, for instance,[1] that Syria alone possesses four distinct breeds—namely, a light and graceful type with a pleasant, easy gait, used by ladies of rank; a so-called Arab breed, reserved entirely for the saddle, and carefully groomed and tended; a stouter and more clumsily made strain employed for ploughing and other agricultural operations; and, lastly, the large Damascus breed, characterised by its length of body and inordinately long ears. Many of these Damascus asses are white, and are apparently identical with a breed reared at Bagdad, where they have been highly esteemed for centuries, both on account of their colour and their speed. Writing of the Syrian riding ass, Canon Tristram[2] states that it "will accomplish quite as long a day's journey as the horse or the camel; though its speed is not so great, it will maintain an easy trot and canter for hours without flagging, and always gains on the horse up the hills or on the broken ground."

In addition to Syria and Palestine, asses of a dirty white colour are spread over Egypt, Persia, and some of the neighbouring countries. Formerly, at any rate, asses were largely kept in the East for the sake of their milk, which, as is well known in

[1] See Darwin, *op. cit.*, p. 65.
[2] *Natural History of the Bible*, London, 1867, p. 39.

Europe, is highly nutritive; droves of she-asses forming a special feature among the possessions of the Biblical patriarchs.

Large and long-eared as is the white ass of Damascus and Bagdad, it is exceeded in both these respects by the famous Poitou breed of France, which stands from about 13½ to as much as 16 hands at the shoulder, and varies in colour from grey to black; the black ones being the most highly valued. These Poitou asses, which rival cart-horses in size and make, are ugly-looking beasts, having huge, ungainly heads, enormous ears, in most cases long, heavy coats, pendent manes, stout limbs, and relatively broad hoofs. They are kept almost entirely for breeding mules of a heavy and powerful type. Spain is also celebrated for its asses, which are likewise mainly reared for mule-breeding; Andalucia and Catalonia being two of the provinces where they are reared in the greatest numbers. Although coloured like the Poitou breed, of which they are believed to be the ancestral stock, they are somewhat inferior in stature and lighter in build; the same characters reappearing in the mules.

As the Poitou donkey marks the maximum development of the species in point of size, so the little grey Mahratta donkeys of Western India and Ceylon represent the extreme in the opposite direction, some of them standing no more than 8,

or even $7\frac{1}{2}$, hands at the withers. Despite their diminutive size, they stagger gamely along under huge loads. Some Indian asses are, however, considerably larger, and it is not uncommon to see one of these ploughing with a humped ox or buffalo for its yoke-fellow, while on rare occasions a camel and an ass may be seen ploughing the same furrow.

To refer to the domesticated asses of all parts of the world would be of little use or interest, even if it were possible. Brief mention may, however, be made of those of Majorca, in the Balearic group, where there are two distinct breeds, of which the larger is extensively exported to the United States for mule-breeding. The smaller breed is a dwarf grey animal, imported from Northern Africa, and employed for carrying small loads or children. The second and more abundant breed is a larger animal, apparently allied to the asses of Spain, and described as being black or dull chestnut in colour, with the usual white muzzle and under-parts. According to a figure given by Dr. C. Keller,[1] from whose work the foregoing details are taken, the tail appears to be somewhat more fully haired than is usually the case.

A special characteristic of the domesticated ass is its surefootedness, a feature in which it differs markedly from the horse.

[1] "Studien über die Haustiere der Mittelmeer-Inseln," *Neues Denkschr. Schweiz. Naturfor. Ges.*, vol. xlvi. p. 112, 1911.

CHAPTER X

MULES AND OTHER HYBRIDS

THE fact that mares and male asses will readily interbreed, although their product is sterile, has been known from very early times; Homer mentioning in the Iliad that the hemionus, or mule, originally came from Henetia, in Pontic Asia Minor, which was inhabited by a Paphlagonian people. In a second passage it is stated that mules were brought to Priam at Troy from Mysia; this according well with the first statement, as the Mysians and Paphlagonians were neighbours, and the route to the country of the former lay through that of the latter.[1] To the Greeks, the mule was known either as *hemionus* (half-ass)—a name now employed as the scientific designation of the onager—or *oreos* or *oureos* (the mountain animal); the latter title being given from the fact that mules were used to carry loads of wood from the mountains to the plains.

The word mule is derived from the Latin *mulus*, which is itself believed to take its origin from the Greek *muchlos*, a breeding ass, the

[1] Heyn and Stallybrass, *Wanderings of Plants and Animals*, p. 111.

omission of the *ch* being compensated by the lengthening of the preceding vowel. *Muchlos* appears to have been taken from the Phocæans, who were the mariners and colonisers of the West.[1] As already mentioned incidentally, the mule is properly the product of the male ass and the mare, the converse hybrid—that is to say, the product of crossing a stallion with a she-ass—being termed hinny, a word derived, through the Latin *hinnus*, from the Greek *hinnos*, or *ginos*.

Mule has, however, come to be used for any hybrid, *e.g.* a mule-canary.

With the possible exception of a few instances in which the female is stated to have produced offspring, the mule is sterile ; as, indeed, might be expected to be the case when the difference between its parents is borne in mind.

On this subject Sir E. Ray Lankester has written as follows in one of his articles, "Science from an Easy-Chair," published in the *Daily Telegraph*:—

"A good case by which to exemplify our conception of a species is that afforded by the species which are united in the genus *Equus*—the horse-genus. There are living at the present day several wild kinds of *Equus*—namely, the wild horse, or tarpan, of the Gobi desert of Mongolia, called after Przewalski ; two kinds of Asiatic wild ass, called

[1] Heyn and Stallybrass, *op. cit.*, pp. 461, 462.

the kiang and the onager; the African wild ass; and two or three kinds of zebra. There are, besides, many kinds of domesticated horses, ranging from the Shetland pony to the Flemish dray-horse, and from the shire horse to the Arab. Then there are many kinds of fossil extinct horses known, some of which clearly must be placed in the genus *Equus* with the living kinds, others which have to be separated into special genera (*Hippidium*, *Onohippidium*, &c.). Now, as to the living forms or form-kinds of the genus *Equus*, which are we to regard as true species, and which are only varieties and races of lower significance than species? The answer is clear enough in regard to several of them. The wild Mongolian horse and all the domesticated horses are varieties, races, or breeds of one species, judged not only by such marks as the possession of callosities on both the hind and the fore legs, but also by the test of breeding. They breed together and produce persisting races. But the asses and the zebras, though they will form mules with the horse, do not freely breed with it, nor establish a hybrid race. They are distinct from the horse, not only in markings and certain details of shape and hair, but in the fact that they cannot be fused into one race with him. There are no sufficient experiments on the aloofness of zebras and asses from one another in regard to breeding, although it seems that they

cannot establish a mixed race, and are therefore distinct species judged by that test as well as by their form and marking. It is not known whether the so-called species of wild ass—the Asiatic and the African—would prove to produce fertile or infertile mules if inter-crossed, nor has the test been applied to the very differently marked local races of the African zebras—Grévy's zebra, Burchell's zebra, and the mountain zebra. It is likely enough that the three or more species distinguished among zebras on account of their being differently striped, and existing in different localities, would be found to breed freely together, and prove themselves thus to be entitled to be regarded as local 'varieties' or 'races,' but not as fully-separated, true species."

In this passage the writer definitely commits himself to the opinion that the fertility or sterility of the hybrids produced by crossing two distinct members of the horse family (or, for that matter, of any other family) affords a definite and decisive test whether such members should be regarded as races or breeds of one and the same species, or as distinct species. Such information as we possess on the subject,[1] comparatively meagre as it is, does not, however, justify a sweeping generalisation like the above, for there is really no hard-and-fast line

[1] Much interesting information on horse and zebra hybrids will be found in Professor J. C. Ewart's *The Penicuik Experiments*, London, 1899.

of distinction between races and species; the former being practically species in the making. On the contrary, fertility or sterility in the hybrid depends on whether the two species (or even races) severally represented by the parents are near or distant relations of one another. For instance, the Arab horse, whether it be regarded as a distinct species or merely as a race of *Equus caballus*, as exemplified by the wild tarpan, is clearly not far removed from the latter, and the two therefore interbreed freely. Again, as already mentioned, the horse and the ass are two of the most widely sundered members of the equine family, and their hybrids are therefore sterile.

On the other hand if hybrids between the African wild ass and the true zebra, which as we have seen are nearly related, were to prove fertile, as they well might, this would be no argument for regarding those animals as races of a single species, and the same would be the case if fertile hybrids—which is improbable — were the result of a union between the bontequagga and Grévy's zebra or between the latter and the true zebra.

Practically all that can be inferred from the interbreeding of the various members of the horse family, so far as systematic zoology is concerned, is that the whole of them are rightly included in the single genus *Equus*.

Although no complete list of all the hybrids

that have been produced between different members of the horse family is available, it appears that crossing has taken place between nearly all of them. Unfortunately, there is very little information with regard to the fertility or sterility of the hybrids, except in the case of the mule and the kiang. There are, however, some undoubted instances of partial fertility in the hybrids; one of the best known being a hybrid between the zebra and the wild ass born many years ago at Knowsley Park, the seat of the Earls of Derby, which gave rise to offspring when crossed with a bay pony mare.

On some of the farms of Cape Colony individuals of the true zebra are occasionally allowed to run with domesticated donkeys, with which they may interbreed. In 1896 I received a photograph of a fœtus apparently belonging to a hybrid of this nature, sent by Mr. F. W. FitzSimons, director of the Port Elizabeth Museum. The specimen which is mounted in that museum was prematurely born, but is fully developed, even to the hardening of the hoofs. Whereas, however, the limbs are transversely banded with black in the same fashion as in the zebra, the colouring of the body is of a totally different type. The ground-colour is a warm buff, lightest on the limbs. The whole of the neck is marked with a great number—many scores—of very narrow, vertical black lines, totally different from the broad black stripes of

the zebra. The mane is also black; and a black line is continued from its termination to the root of the tail, where it spreads out into an ill-defined indistinct black patch. Nothing was stated in the original description with regard to the presence of any dark markings on the rest of the body, but from the photograph this area, like the head, appears to be whole-coloured.

A somewhat similar type of colouring is presented by an adult hybrid in the British Museum (vol. xxi. fig. 2), which was born about the year 1844 in the menagerie kept at that time by the Earl of Derby at Knowsley Park. It is reputed to be the offspring of a male zebra (*Equus zebra*) and a female onager (*E. onager*).[1] In the length of the ears and the black barring, on a white ground, of the legs, this hybrid approximates to its male parent, although lacking the white tip to the ears characteristic of all the members of the zebra group. The general colour of the head, neck, and body is, however, mouse-brown, with narrow, darker stripes on the face and neck, and one broad and complete and two narrower and imperfect shoulder-stripes. The rest of the body is marked with chocolate flecks, incompletely aggregated into inconspicuous narrow stripes.

In a paper on hybrid foals published in the

[1] See Gray, *Handlist Edentate, Thick-skinned, and Ruminant Mammals in Brit. Mus.*, p. 38, London, 1873.

Proceedings of the Zoological Society for 1911 [1] Mr. R. I. Pocock remarks on the similarity between this or another hybrid of the same nature born at Knowsley [2] and the undermentioned offspring of a male Somali wild ass and a female zebra.

In the summer of 1911 hybrids between a male Somali wild ass and a Matabili bontequagga (*E. burchelli chapmani*) on the one hand and a zebra (*E. zebra*) on the other were born in the London Zoological Gardens, of which Mr. Pocock has given the following description :—

"In both hybrid foals the head, neck, and body are practically self-coloured, with the exception of the spinal, ventral, and shoulder stripes, a few narrow brown stripes above the muzzle on the nose, and a shading of ashy grey on the lower part of the neck. The mane is unstriped, but the legs are well banded up to the level of the belly or thereabouts. The ears have a dark basal stripe and a terminal black patch, but the white ear-tip seen in zebras and quaggas is absent. On the other hand, the white area present just above the muzzle in asses is absent. In the absence of the shoulder and spinal stripes and of the patch on the base of the ear, the Somali donkey differs from the domesticated animal. . . . Two features characteristic of the

[1] Page 991.

[2] In the specimen referred to by Mr. Pocock the onager is stated to be the sire.

zebra, namely, the dewlap and the reversal of the spinal hair, have been eliminated in the hybrid; and it is noticeable that the hair along the spine, especially on the croup, is as long as in the foal of Grévy's zebra. The two foals are not exactly alike, differences in detail being detectable everywhere. The ears, for example, are smaller, their basal stripe is narrower and blacker, the shoulder-stripe is shorter, the spinal crest less pronounced, and the legs are less strongly banded in the quagga than in the zebra foal. The resemblance, nevertheless, between the two is striking."

Although the aforesaid hybrid between the Somali wild ass and the zebra is the only known example of such a cross, mules between the domesticated ass and zebra have been known from the time of Cuvier. A hybrid of this nature, whose male parent was a black Spanish ass, described by Cuvier himself, is stated by Mr. Pocock to have been like the product of the Somali wild ass and zebra, except that, when adult, the ground-colour was dark grey, even on the legs, and there were spots at the base of the tail. Both these hybrids lacked the white ear-tip of the zebra and the white muzzle of the ass.

All these hybrids agree in the absence of the white zebra ear-tip and the white asinine muzzle, as well as in the more or less complete suppression of the stripes on the head and body; and it is very

noteworthy that when such striping does occur it is of the narrow type characteristic of Grévy's zebra and the undermentioned bontequagga-pony hybrid.

All the races of the bontequagga will interbreed; and it is probable that in some instances the hybrids may be fertile, although they are generally as sterile as mules. Recently a hybrid foal between a female of the Matabili *E. b. burchelli* and a male of the East African *E. b. granti* was born in the Royal Dublin Zoological Gardens. The noticeable feature in this foal is that while the legs have the complete barring of those of *granti*, the body shows the shadow-stripes of *chapmani;* this illustrating the potency of leg-barring.

The Matabili bontequagga has been crossed by Professor Ewart with a black pony mare from the Isle of Man and also with bay ponies. The resulting progeny (pl. xxi. fig. 1) were bay in ground-colour, but more or less fully marked, with narrow and closely approximated dark stripes, quite unlike those of the male parent in width and number, and to a considerable extent also in direction. Probably, as in the instances noted above, they indicate reversion towards an earlier ancestral type.

Hybrids of this type have been used for draught and riding in countries unsuited to horses, and they are believed to be immune to the attacks of tsetse-fly. Whatever may be their value under such circumstances, it is unlikely that these zebra-hybrids,

PLATE XXI

FIG. 1

FIG. 2

FIG. 1. Hybrid Bontequagga and Pony Colt ("Romulus") and Dam.
FIG. 2. Hybrid Zebra and Onager.

as they are commonly called, will ever come into general use, since they have the disadvantage that one of their parents is always a wild animal, whereas a mule is the product of species which have been domesticated for centuries.

In the case of both mules and hinnies the general build and appearance of the animal accord with the type of the sire, although in the matter of bodily size the dam is followed. Mules are therefore asinine in appearance, although with a more horse-like tail, and relatively large ears; whereas the more horse-like hinny is small. If, however, females of the great Poitou ass were to be utilised for hinny-breeding, the progeny would probably be of larger stature. One exception to the ass-like character of the mule is that it lacks the white belly of its male parent. Hinnies, on account of their inferior size and strength, are but seldom bred, although they are used to a certain extent in some parts of Ireland.

Mules are comparatively uncommon in England, but are extensively employed in many parts of the Continent, such as Spain, and on account of their surefooted character, which they inherit from the ass, are especially suited to mountain work. They are largely employed in the Punjab, more particularly in the frontier districts, for military purposes, where there are mule-batteries for hill-work. These batteries are armed with light field-guns, which are

so constructed as to be readily taken to pieces, when the constituent parts are easily carried on mule-back, through country which would be impracticable for ordinary field-artillery. In addition to their surefootedness, mules, in proportion to their size, are stronger and more enduring than horses; like the ass, they will also thrive on poorer fodder, while they are likewise less liable to disease than horses, and are said to be longer-lived. In America mules are very largely employed; and in Brazil, when the lines of railway are left, travelling in the drier districts is to a great extent accomplished in light carriages drawn by four or six mules, which are driven by the coachman.

"Obstinate as a mule" has become a proverb; but the supposed obstinacy and vice are largely the result of ill-usage; and, although some individuals are incurably vicious, mules when properly treated and handled are quite amenable animals. Many years ago I rode a mule for several months in the Punjab, and found it in every respect an admirable mount.

A large number of light-coloured mules, particularly in the Punjab, exhibit dark barrings on the legs, and occasionally a shoulder-stripe. Writing on this subject, Darwin[1] observes that "such mules are generally light-coloured, and might be called fallow-duns. The shoulder-stripe in one instance

[1] *Animals and Plants under Domestication*, vol. ii. p. 16.

was deeply forked at the extremity, and in another instance was double, although united in the middle. Mr. Martin gives a figure of a Spanish mule with strong zebra-like marks on its legs, and remarks that mules are particularly liable to be thus striped on their legs. In South America, according to Roulin, such stripes are more frequent and conspicuous in the mule than in the ass. In the United States, Mr. Gosse, speaking of these animals, says that in a great number, perhaps in nine out of every ten, the legs are banded with dark transverse stripes." In a later paragraph Darwin continues as follows: "From these facts we see that the crossing of the several equine species tends in a marked manner to cause stripes to appear on the legs. As we do not know whether the parent-form of the genus was striped, the appearance of the stripes can only hypothetically be attributed to reversion. But most persons, after considering the many undoubted cases of variously-coloured marks reappearing by reversion in my experiments on crossed pigeons and fowls, will come to the same conclusion with regard to the horse-genus; and if so, we must admit that the progenitor of the group was striped on the legs, shoulders, face, and probably over the whole body, like a zebra."

While fully admitting the cogency of this argument, it may be suggested that the striping may

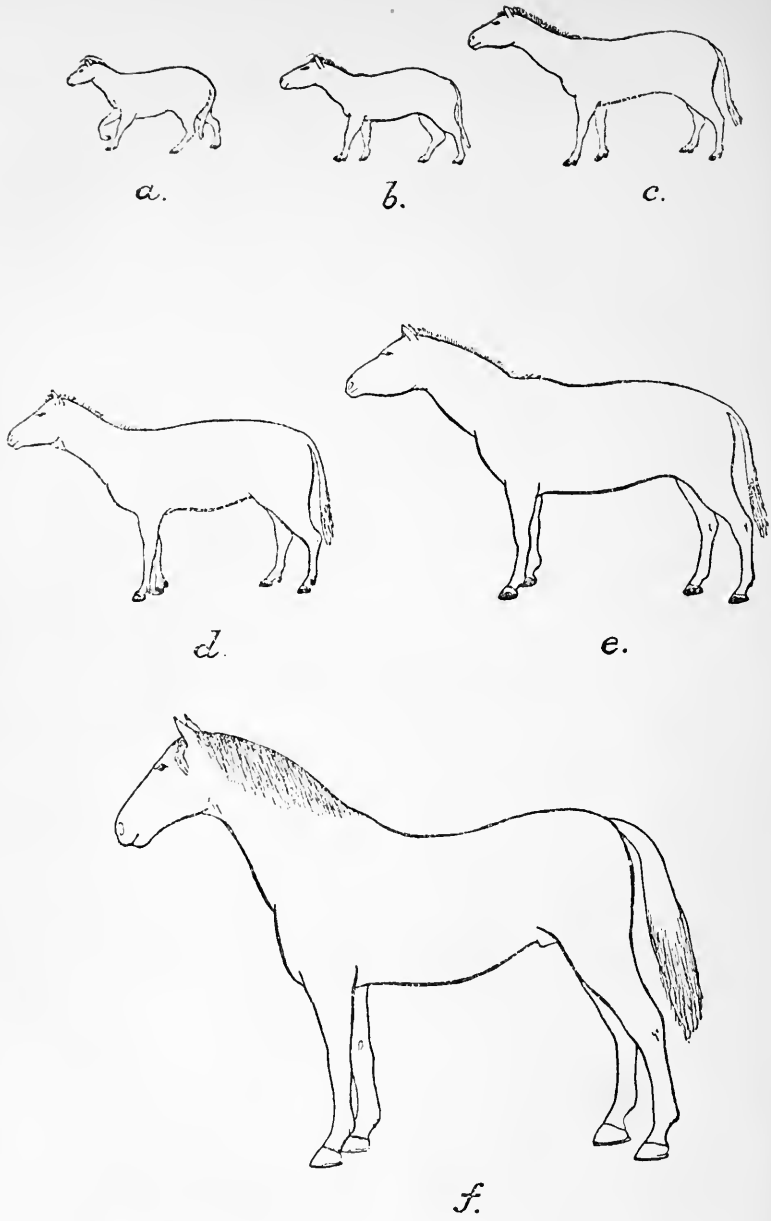
have existed only in the proximate ancestors of the modern members of the horse group, and that the earlier progenitors were not thus marked. Indeed, it has been mentioned on page 52 that there are reasons for believing that the earlier members of the horse-stock had a totally different type of colouring.

CHAPTER XI

THE EXTINCT FORERUNNERS OF THE HORSE

Of few mammals has the record of their past history been so well preserved as is the case with the horse and its existing relatives; for as we descend through the five stages — Pleistocene, Pliocene, Miocene, Oligocene, and Eocene—of the uppermost, or Tertiary, epoch of geological history we can trace a more or less complete gradation from the horses of the present day to primitive, many-toed animals, scarcely larger than foxes, and presenting few of the features which render the horse and its relatives such a remarkable group. In other words, from tall, single-toed quadrupeds, adapted for grazing on open plains, and endowed with the maximum speed of which mammalian organisation is capable, we can trace the passage through smaller, three-toed forest-dwelling and browsing animals, to small and almost fox-like creatures which in all probability frequented the swampy shores of lakes and marshes, and were little if any faster than badgers.

How long a period was the evolution from the little four-toed *Hyracotherium* of the Lower Eocene



THE ANCESTORS OF THE HORSE AND ITS RELATIVES COMPARED IN SIZE AND FORM WITH THEIR TYPICAL MODERN REPRESENTATIVE

a, *Hyracotherium* of the Lower Eocene; *b*, *Plagiolophus*, or *Orohippus*, of the Middle Eocene; *c*, *Mesohippus*, of the Oligocene; *d*, *Merychippus*, of the Miocene; *e*, *Pliohippus*, of the Pliocene; *f*, the Horse, *Equus caballus*.

period to the horse of the present day—in other words, what was the length of the Tertiary period, or age of mammals—is a question which must occur to all. To answer that question with any approach to correctness in terms of years or centuries is a practical impossibility, although it has been frequently attempted; and all that can be done is to endeavour to convey by means of the stupendous events which have taken place during the Tertiary period some faint idea of the enormous length of time represented by that latest stage in the geological history of our globe.

This mode of gaining some idea of the immense lapse of time which has taken place during the slow evolution of the Eocene *Hyracotherium* into the modern *Equus*, or, in other words the birth of mountain-chains during the Age of Mammals, has been well expressed by Professor H. F. Osborn,[1] who writes as follows:—

"The Rocky Mountains, it is true, began their elevation during the close of the Age of Reptiles [that is to say, during the Secondary period, which immediately preceded the Tertiary, and includes the Chalk and Oolites]; they had only attained a height of four or five thousand feet when the Age of Mammals commenced; they continued to rise during the entire period. But consider the map of Europe and Asia at the beginning of Eocene time

[1] *The Age of Mammals*, New York, 1910, p. 58.

and realise that the great mountain systems of the Pyrenees, the Alps, and the Himalayas were still unborn, level surfaces in fact, partly washed by the sea. The birth of the Pyrenees was at the beginning of the Oligocene. At this time Switzerland was still a comparatively level plain, and not until the close of the Oligocene did the mighty system of the Swiss Alps begin to rise. Central Asia was even yet a plain and upland, and only during the Miocene did the Himalayas, the noblest existing mountain chain, begin to rise to their present fellowship with the sky. In North America, again, since the close of the Eocene the region of the present Grand Cañon of the Colorado has been elevated 11,000 feet, and the river has carved its mighty cañon through the rock to its present maximum depth of 6500 feet.

"Those who have been impressed with a sense of the antiquity of these wonders of the world, and will imagine the vast changes in the history of continental geography and continental life which were involved, will be ready to concede that the Age of Mammals alone represents an almost inconceivable period of time."

Admirably as is this aspect of the subject expressed by Professor Osborn, the force of the comparison would have been intensified if it had been mentioned that at the time when the fox-like *Hyracotherium* was wandering in the marshes of

Kent not only was the Himalaya non-existent, but that along the line of its very heart—where the kiang now lives at an elevation of from thirteen thousand to sixteen thousand feet—extended an arm of the sea of no inconsiderable depth.

Although one of the earliest forerunners of the horse-tribe, the above-mentioned *Hyracotherium*, lived in England during the deposition of the Lower Eocene London Clay, the evolution of the *Equidæ* is much more clearly displayed in the Tertiary strata of North America than it is in those of Europe, where the chain is completely broken during the Oligocene epoch. From this it has been inferred that the entire evolution took place on the American continent; although as mentioned in an earlier chapter, the real birthplace was probably in East Central Asia, whence the group spread in one direction into Europe, and finally Africa, and in the other into North America, and thence, during the late Pliocene epoch, when the two continents became united, into the southern half of the New World.

In both North and South America members of the horse-family survived into the Pleistocene epoch; those of the northern continent belonging to the existing *Equus*, whereas those of the southern continent represented extinct generic types. In North America the whole group died completely out at the close of the Pleistocene; and it is

generally believed that the same thing took place in South America.

Why this sudden disappearance of a dominant and thriving group occurred was long a puzzle. It was not that the country had become unsuited to these animals, for when domesticated horses were introduced and escaped from captivity, they ran wild and increased amazingly in both halves of the New World. This suggests that the extinction was probably brought about either by bacterial infection or by a disease analogous to that produced by the agency of tsetse flies in certain parts of Africa at the present day. In connection with the latter part of this suggestion, it is especially noteworthy that remains of extinct tsetses have been discovered in the Miocene formation of Florissant, Colorado.

The existing genus *Equus*, which, as shown in the preceding chapters of this volume, includes all the living members of the family, extends downwards through the Pleistocene into the upper portion of the Pliocene period alike in North America, Asia, and Europe. Possibly it may go as low down as the Lower Pliocene in the Siwalik Hills of India, although this is uncertain, as the higher beds of the Siwaliks, which contain remains of true horses, may prove to belong to the upper part of the Pliocene epoch.

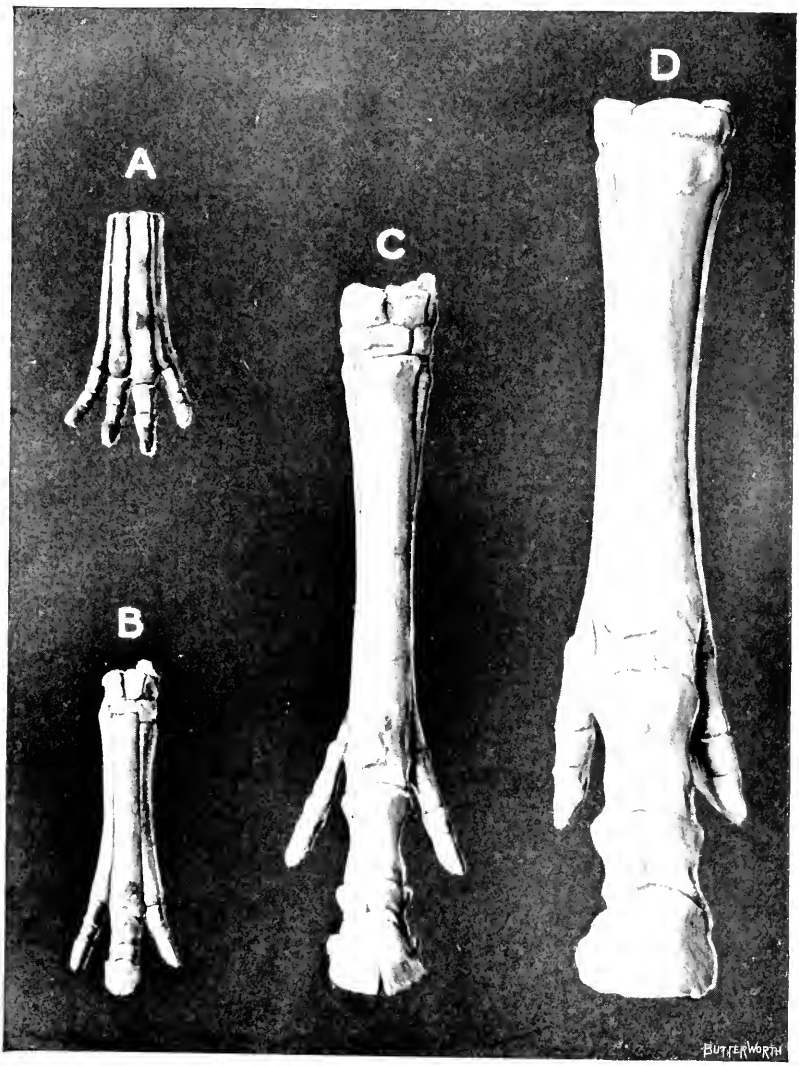
Here it may be well to recapitulate a few of

the leading features of the genus *Equus*, which includes the largest, and doubtless the swiftest, members of the entire group, all of which are fitted for a life on the open plains, where they subsist entirely by grazing. In correlation with this kind of life is the great length and columnar structure of the cheek-teeth, which show an intricate enamel-pattern on the grinding surface, and are characterised by the union of the antero-internal pillar of those of the upper jaw with the main body of the crown by means of a narrow neck, as shown at A of the figure on page 33; the hollows between the enamel-foldings being completely filled with cement. In the skull the socket of the eye is surrounded by a complete ring of bone, there is no deep depression or pit immediately in front of the same, and the slit between the fore part of the upper jaw and the nasal bones is short. A long gap, or diastema, in the front half of which are implanted the tusks, or canines (when these are present), separates the incisor from the cheek-teeth; and the crowns of the incisors themselves are penetrated, in early life, by the pit, or "mark," which has already been sufficiently described. Each limb terminates in a single hoof, upon which alone the animal walks; but the lateral toes—second and fourth—of the extinct three-toed members of the family are represented by splints, which may either remain free or be welded to the adjacent cannon-bone.

As mentioned in earlier chapters, the Prehistoric and Pleistocene deposits of Europe and Turkestan have yielded remains inseparable for the most part at any rate from the modern horse (*Equus caballus*), of which they probably represent several phases or races, while others have been assigned to the ass (*E. asinus*), and yet others to the onager (*E. onager*). From the Pleistocene gravels of the Narbada Valley, in Central India, have been obtained skulls and other remains of a horse (*E. namadicus*) characterised by the elongation of the grinding surface of the anterior pillars on the inner side of the upper cheek-teeth; the same species also occurring in the topmost beds of the Siwaliks of Northern India.

In North America the Pleistocene and Upper Pliocene formations have yielded remains of at least nine extinct members of the modern genus; one of these, *E. fraternus*, closely resembling *E. caballus*, while a second, *E. giganteus*, from South-western Texas, appears to have been the largest of the whole group; the cheek-teeth exceeding those of the biggest cart-horses by more than one-third the diameter of the latter.

In the Upper Pliocene deposits of the Val d'Arno and other parts of Europe, including the so-called Forest Bed of the coast of Norfolk, occurs a horse (*E. stenonis*) with molars of a somewhat more primitive type than those of the existing



Bones of fore-feet of extinct forerunners of the Horse. A, *Hyracotherium*, or *Eohippus*; B, *Mesohippus*; C, *Merychippus* or *Protohippus*; D, *Hipparion*.

members of the genus; the primitive feature being the shortness of the antero-internal pillar of those of the upper jaw. There is also a slight depression in the wall of the skull immediately in advance of the socket of the eye. Nearly allied to Steno's horse is *Equus sivalensis*, of the Pliocene deposits of the Indian Siwaliks, which, as already mentioned, exhibits both the aforesaid features. So far as can be determined, this Siwalik horse seems to have stood about 15 hands at the shoulder, and to have had a relatively big head, and slender cannon-bones, with proportionately large splints.

After mentioning that in respect of their upper molars *Equus stenonis* and *E. sivalensis* occupy an intermediate position between the modern members of the genus and the extinct Pliocene *Protohippus*, Prof. Marcellin Boule[1] proceeds to observe that when a large series of the remains of the first-named species is studied, "it will be found that in respect of stature, of the plications of the enamel of the upper molars, and of the shape of their inner pillars, *Equus stenonis* presents individual variations comparable to those which occur in the different varieties or races of the horse, both of the Pleistocene and modern epochs. Certain teeth, of relatively small size, display remarkable resemblances to those of the ass; and I have shown that milk-teeth of

[1] "Les Chevaux fossiles des Grottes de Grimaldi," *Ann. de Paléontologie*, vol. v. p. 130, 1910.

E. stenonis from certain Pliocene formations in the Auvergne and Velay present certain features now found only among zebras. I have also shown that other teeth, from a higher horizon in the Pliocene, differ from the former by their larger size, the more complicated folding of the enamel, the greater length of the anterior pillar, and certain other features connecting them with the Pleistocene representatives of *E. caballus*, more especially those molars with very complicated enamel-foldings, like those from England described by Owen as *E. plicidens*, and those from certain French caverns, such as Cindré and Bruniquel.

"It appears, then, that the *stenonis* type was extremely variable during the Pliocene, being represented by forms already showing tendencies towards various modern groups of *Equidæ*. Among these forms, all of which are remarkable on account of the shortness of the anterior pillar of the upper cheek-teeth, some were of small size, and apparently related to the asses, having the enamel-folds of the cheek-teeth relatively simple, and their external lobes dilated; these seem to have developed directly into the zebras of modern Africa. Others, of larger size, with the enamel of the molars more plicated, and the external lobes forming more pronounced crescents, appear to have passed insensibly into some of the larger forms of *Equus caballus* found in certain Pleistocene formations."

After remarking that the modern horse dates back to the Pleistocene, or Quaternary, epoch, but is unknown in the Pliocene, Prof. Boule observes that "it is found at Chelles and in most of the deposits of the great interglacial period. It persists right through the Quaternary, everywhere in abundance. It is represented in the Middle Pleistocene by races or varieties, to which it is possible to affiliate certain modern races or varieties. Finally, it seems that the evolution of this useful and interesting animal continues to the present day, and that under human influence it will still continue to progress."

That the extinct Indian *E. sivalensis* and *E. namadicus*, which, as already mentioned, differ from one another in the length of the grinding surface of the anterior pillar of the upper cheek-teeth (this being short in the former and long in the latter), gave rise to successors seems almost certain. At one time I suggested[1] that the kiang might be derived from *E. sivalensis*; but the cheek-teeth of the former are so much smaller than those of the latter, that this seems unlikely. A latter suggestion is that if the Arab be specifically distinct from *E. caballus* it may have originated from the Siwalik species, probably through the later Narbada horse.

[1] *Palæontologia Indica* (*Mem. Geol. Surv. India*), ser. 10, vol. ii. p. 89, 1882.

In North America the immediate precursor of the modern *Equus* is the genus *Pliohippus*, whose remains occur in deposits belonging to the Lower Pliocene and to the antecedent Miocene epoch. Whether this was a completely single-toed animal, or whether there were small remnants of the lateral toes, appears uncertain. If these were present they must, however, have been extremely small and quite functionless, as the splint-bones are scarcely larger than in the modern horse.[1] The cheek-teeth are larger than those of the undermentioned *Protohippus*, but owing to the relative shallowness of the jaws, as compared with those of *Equus*, their crowns were still more sharply curved. *Pliohippus*, as typified by *P. pernix* of the Loup Fork beds of Nebraska, was the largest of the contemporary horses, standing about 12 hands at the withers, and thus equalling a good-sized pony. The range of the genus included the Western United States, especially Nebraska and Oregon. Not improbably this or a closely allied form was the direct ancestor of *Equus*.

It has likewise been suggested that *Pliohippus* gave rise to the remarkable *Hippidium* (*Hippidion*) and *Onohippidium* of the Pleistocene deposits of South America: this is considered problematical by Prof. Lull, although more favourably received

[1] See R. S. Lull, "The Evolution of the Horse Family," *Amer. J. Science*, ser. 4, vol. iii. p. 478, 1907.

by Prof. Osborn.[1] That the ancestors of the two South American genera came from the north is practically certain; and it is therefore probable that such ancestors were identical with or closely allied to either *Pliohippus* or *Protohippus*.

Hippidium as typified by *H. neogæum* and its near relative *Onohippidium munizi* were small, heavy-headed horses, differing in many important details from all other members of the family. In both genera the cheek-teeth have shorter crowns and differ in several details of structure from those of modern horses. A cast of the skeleton (pl. xxiii.) in the British Museum stands $12\frac{1}{4}$ hands at the withers, while the skull measures $23\frac{1}{2}$ in. in total length. In a European horse-skeleton standing $14\frac{1}{2}$ hands the skull-length is about $23\frac{3}{4}$ in., or practically the same as in the much smaller *Hippidium*. Comparison of the skull of the latter with that of an ordinary horse shows a remarkable difference in the structure of the nasal region. In the horse the nasal bones are separated from the maxillæ, or upper jawbones, of each side by a slit of only some three or four inches in length. In *Hippidium* and the allied *Onohippidium* (pl. xxiv. fig. 1), on the other hand, these slits are about $10\frac{1}{2}$ in. long, while the nasal bones themselves are proportionately long and slender. This indicates that these extinct American genera had extremely

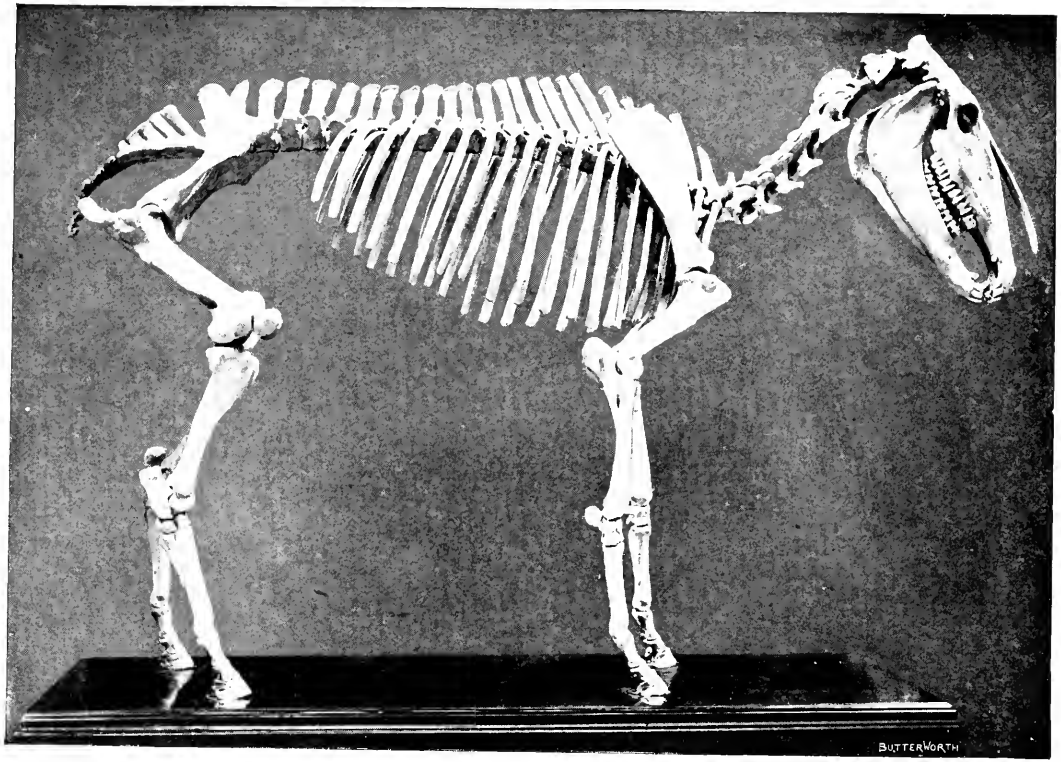
[1] *Op. cit.*, p. 356.

elongated noses, not improbably forming a kind of short trunk comparable to that of the saiga antelope.

In that animal, as well as in its relative the chiru of Tibet, the increased size of the nasal chamber has been brought about by a shortening, instead of an elongation, of the nasal bones, but it is probable that in these two antelopes and in the hippidium the purpose of the modification is the same. It has been supposed that in the case of the chiru the large size of the nasal chamber is an adaptation to the respiratory needs of an animal living at a very high elevation; but in the case of the saiga such an explanation cannot hold good; and the real explanation in all three cases may perhaps be found in a special adaptation to a desert life, the long nose serving as a filter to prevent particles of sand reaching the organ of smell.

As regards the rest of its skeleton, *Hippidium* is remarkable for its short and stout limbs; this being chiefly due to the excessive shortness of the cannon-bones, which are also unusually wide, and the great stoutness of the splint-bones. Each limb terminates in a single toe. These short limbs, coupled with the huge, unwieldy head, indicate that the hippidium had less speed than ordinary ponies. There are only five ribless trunk, or lumbar, vertebræ, as in the Arab horse.

The skull of *Hippidium* shows no marked



Skeleton of *Hippidium*, about $\frac{1}{11}$ natural size.

depression in front of the eye-socket, but that of *Onohippidium* has a long and deep oval pit in this position divided into two distinct portions. Remains of this group of extinct horses have been found in the superficial deposits of the pampas of Argentina, and also in caverns in Patagonia, Brazil, Bolivia, Peru, and Ecuador. The Peruvian species was described in 1908 by Mr. Nordenskiöld[1] as *Onohippidium peruanum*, but in 1910 was made the type of a distinct genus, under the name of *Hyperhippidium peruanum*.[2]

In all three genera the crowns of the cheek-teeth are shorter than in *Equus;* and those of the upper jaw are characterised by the equality in the size of the grinding surfaces of the anterior and posterior pillars on the inner side.

Hoofs of *Onohippidium* have been found in a remarkably fresh state of preservation in a cavern at Ultima Esperanza (Last Hope) Inlet, Patagonia, in association with the skin and hair and other remains of an extinct giant ground-sloth (*Grypotherium*). Since it is practically certain that the latter lived during the human period, it is most likely that the same was the case with *Onohippidium.* Now it has been suggested that certain wild horses seen in Argentina by John Cabot in the year 1530

[1] *Arkiv für Zoologi*, Stockholm, vol. iv. No. 11, p. 17.

[2] I. Sefoe, "*Hyperhippidium*, eine neue Südamerikanische Pferdegattung," Stockholm, *Vet. Ak.-Handl.* vol. xlvi. pt. 2, p. 1.

were really indigenous, and not the descendants of European horses escaped from captivity (the date appearing too early for European horses to have established themselves in the country). If this suggestion be well founded, it is quite certain that Cabot's horses were survivors of the *Onohippidium*.

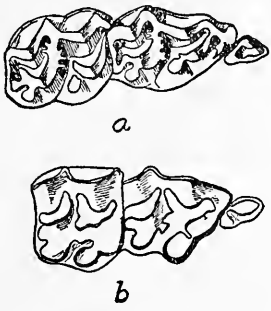
Reverting to the North American members of the group, the next genus for notice is *Protohippus*, of the Loup Fork Miocene, which is closely related to the undermentioned contemporary *Merychippus*, but differs by the full development of cement in the cheek-teeth of the milk or deciduous series, as well as in those of the permanent set. Owing to the shallowness of the jaws, the crowns of these teeth are highly curved; they are also relatively shorter than in *Equus*, and have much the same pattern on the grinding surface as those of *Hippidium*. The splint-bones of the feet are complete, and terminate in small, although perfect toes, so that *Protohippus* was a three-toed animal. The typical species of the genus stood only 9 hands at the shoulder.

Certain equine remains from the Miocene of Russia have been referred to *Protohippus* by Madam Pavlow,[1] but, as the author herself admits, they are too imperfect for definite generic determination.

The aforesaid North American Miocene genus *Merychippus* is the last of the genera in the direct line of *Equus* which have the socket of the eye

[1] *Bulletin de Société des Naturalistes de Moscou*, 1903, p. 173.

surrounded by a complete ring of bone. It is of special interest on account of the circumstance that while its permanent cheek-teeth resemble those of all the preceding genera in having their hollows completely filled up with cement and the whole crown relatively tall, those of the deciduous or milk series are short-crowned, with their hollows open and devoid of cement. The genus thus forms a gradation in this respect from *Protohippus* to the lower



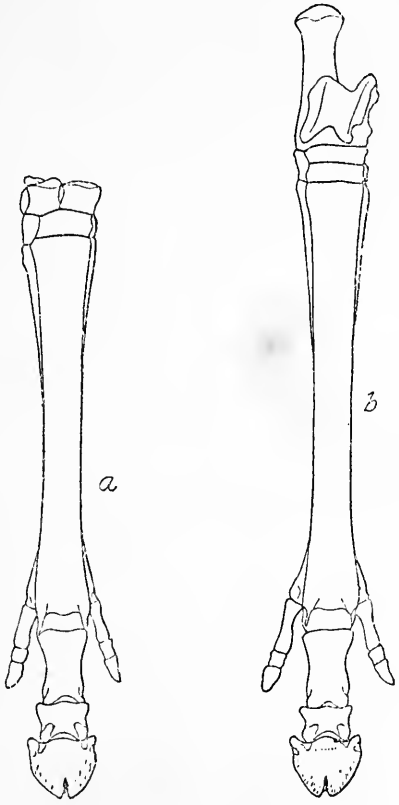
Right Upper Milk-Molars (*a*) and Premolars (*b*) of the Extinct American *Merychippus*, $\frac{2}{3}$ natural size

and more generalised members of the horse-line. The degree of complexity of the enamel-foldings in the crowns of the upper cheek-teeth varies in the different species. The feet are three-toed, with in some instances a rudiment of a fourth, or outermost, toe in the front pair; that is to say, of a toe corresponding with the human little finger. The two lateral toes vary in size in the different species, but in none did they touch the ground, so that the feet,

like those of *Protohippus*, are functionally one-toed. The genus, which ranges in space from Texas to Oregon and Montana, is typically represented by *P. insignis*.

In this place it will be convenient to notice certain horse-like animals which, although attaining very considerable specialisation, evidently form a side-branch, and are off the ancestral line of the modern representatives of the horse family. The group is typified by *Hipparion gracilis* of the Lower Pliocene strata of Germany, Greece, Spain, and other parts of Europe; but is represented in the corresponding formation of India by *H. theobaldi*, and by other species in Persia and China; all of these being animals of the approximate size of a Galloway, but with a shorter head and a deep depression in the skull in front of the socket of the eye, probably for the reception of a lachrymal gland. The lateral toes are rather larger than in *Protohippus*, but as they scarcely reach below the lower end of the first phalangeal of the main digit, they could have been of little or no functional importance. The most characteristic feature of *Hipparion* is, however, as shown in B of the illustration on page 33, that the anterior inner pillar (or protocone, as it is often called) is completely surrounded by a ring of enamel, and is thus entirely cut off from the rest of the crown. In some specimens there are, however, little projections

from the adjacent column of the main body of the crown, which are evidently remnants of the neck of enamel connecting the latter with the anterior



Front View of the Bones of the Right Fore (*a*) and Hind (*b*) Feet of the Extinct American *Hipparion*, $\frac{1}{4}$ natural size

pillar in the more typical members of the family. The grinding surface of the anterior pillar forms a regular ellipse. Another feature of the hipparion

molar is the great complexity of the foldings of the enamel in the central islands of the crown.

The North American hipparions, which occur in the Miocene, have been separated generically from their Old World relatives by Mr. J. W. Gidley[1] as *Neohipparion.* From the typical hipparions the American species are distinguished by the larger size and more elliptical form of the grinding surface of the anterior pillar of the upper cheek-teeth; the simpler folding of the enamel of their central islands; and the concave external walls of

Crown Surface of Left Upper Molar of the Extinct American *Hipparion*, $\frac{2}{3}$ natural size. *pr*, anterior pillar, or protocone

their outer columns. The limbs, more especially the cannon-bones, are also of a longer and more slender type, and the lateral toes appear to be relatively small. Finally, they antedate the Old World species in time, and may thus be near akin to the ancestral form of the latter, if indeed they be not the actual ancestors. At most, however, they are only worthy of subgeneric distinction.

In regard to the anterior pillar, or protocone, of the American genus, Prof. Lull[2] remarks that

[1] *Bull. Amer. Mus. Nat. Hist.*, vol. xix. p. 465, 1903.
[2] *Op. cit.*, p. 179.

whereas "in *Merychippus insignis* the protocone, while attached [by a neck of enamel to the adjacent crescent], tends to become free, yet in *Neohipparion isonesum* the reverse is true in that the protocone, although free, shows a strong reluctance to leave its old association with the anterior crest [crescent]. In other species of *Neohipparion* this is not apparent, the protocone being oval in section, and entirely free in all stages of wear."

In appearance the American hipparions were deer-like, and therefore probably adapted to a high rate of speed. They stood about 10 hands at the shoulder, and were therefore smaller than their relatives of the Old World.

The skull of an hipparion from the Upper Tertiary strata of Samos has been described by Dr. H. Studer[1] as a distinct species, under the name of *H. proboscideus;* the conformation of the extremity of the upper jawbone leading him to conclude that it was provided with a short proboscis in life. As stated in the first chapter, he also believes that in this and other cases where it occurs the preorbital pit is for the attachment of muscles required for the support and working of the proboscis. From the fact that a preorbital pit occurs in *Merychippus*, as well as in *Onohippidium* and other genera, Dr. Studer is inclined to think that a

[1] *Zeits. Deutsch. Zool. Ges.*, 1910-11, p. 11.

proboscis may have been developed in most or all of the forerunners of the horse-group.

Against this view it may be urged that *Hippidium*, which probably had a proboscis like *Onohippidium* —as the skull-structure in the two genera is almost identical—lacks a preorbital pit. As the various opinions in regard to the function of that pit have been fully discussed in the first chapter, no further reference to the subject is necessary in this place.

It remains, however, to add that a small species of hipparion of slender build from the Pliocene strata of the Siwalik Hills of Northern India, described in the first half of the nineteenth century by Messrs. Cautley and Falconer as *Hippotherium antilopinum* (*Hippotherium* being an alternative name for *Hipparion*) is now believed to have lost the lateral toes, and has accordingly been referred to a genus by itself, under the name of *Hippodactylus*. In addition to the typical *Hippodactylus antilopinus*, there is a second Siwalik species, which has been named *H. chisholmi*.[1]

It may be added that in *Hipparion*, as well as in *Merychippus*, the terminal bone of the main toe has a cleft in the middle of its lower front border; this cleft occurring in many of the earlier forerunners of the horse.

All the foregoing genera may undoubtedly be included in the same family—*Equidæ*—as the

[1] G. Pilgrim, *Rec. Geol. Surv. India*, vol. xl. p. 67, 1910.

FIG. 1

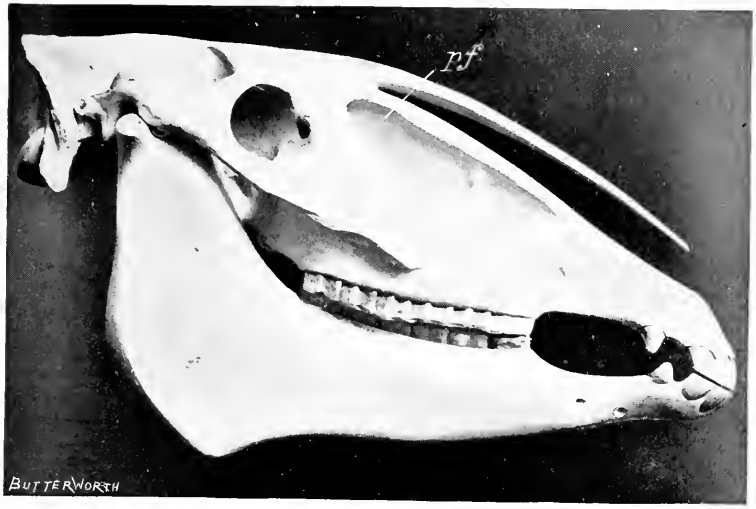


FIG. 2

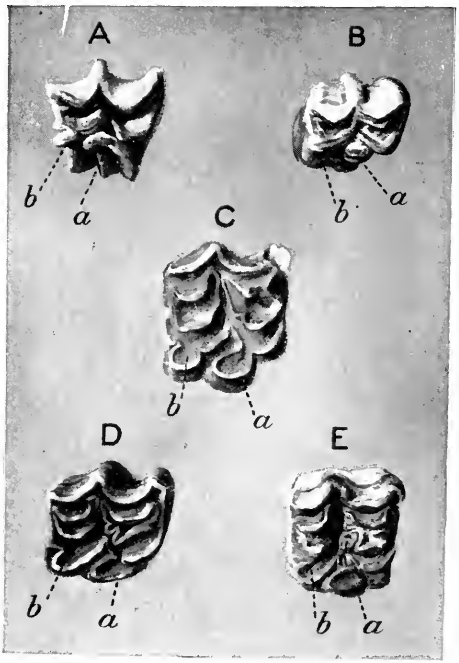
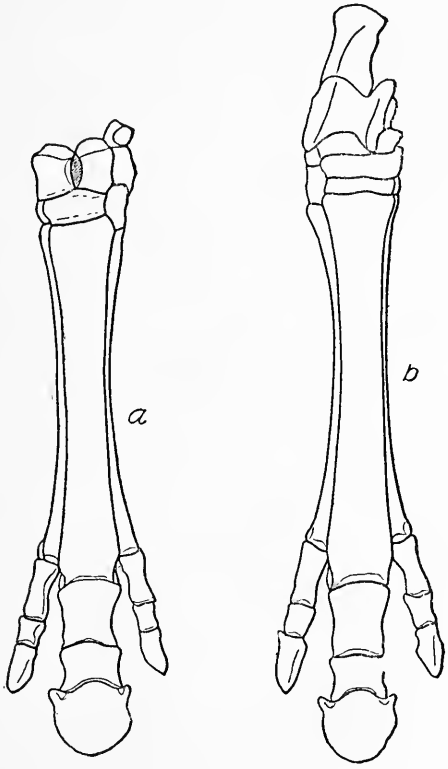


FIG. 1. Skull of *Onohippidium*; *pf*, preorbital depression.
FIG. 2. Crown surfaces of right upper molar teeth of *Equus* (A and D), *Hippidium* (C), and *Hipparion* (E). A and B are almost unworn. *a*, anterior; *b*, posterior pillar.

modern horse; but when we come to the more primitive types, of which the American *Hypohippus* is the first for notice, such remarkable differences from the existing forms are found that the question



Front View of the Bones of the Right Fore (*a*) and Hind (*b*) Feet of the Extinct American *Hypohippus equinus*, ¼ natural size

of the limitations of the family forces itself to the front. And here it may be noted that it is the very completeness of our knowledge of the

horse-line that constitutes the main difficulty; for if the gaps were wider than they are, the division into family groups would be easier. Professor Osborn,[1] like several other American naturalists, cuts the knot by including all the forerunners of the modern horse in the same family as the latter. According to this arrangement, the *Equidæ* is divided into the following four subfamily groups:—

1. EQUINÆ, including the single-toed *Equus*, *Hippidium*, and *Onohippidium*.
2. PROTOHIPPINÆ, represented by the mostly three-toed *Pliohippus*, *Protohippus*, *Merychippus*, *Hipparion*, and *Hippodactylus*.
3. ANCHITHERIINÆ, with the fully three-toed *Hypohippus*, *Anchitherium*, *Mesohippus*, *Anchilophus*, &c.
4. HYRACOTHERIINÆ, including the four-toed *Lophiotherium*, *Orohippus*, *Hyracotherium*, &c.

All these very different types are included by the American naturalists under the general name of "horses," which is, of course, distinctly straining the use of that term to an unjustifiable extent. Moreover, the attempt to include all the members of one line of ancestry—or phylum, as it is called by American naturalists—must break down somewhere, or otherwise we should have to include in the *Equidæ* those members of the mammal-like reptiles from which that group is ultimately derived.

Admitting, then, that arbitrary breaks must be

[1] *The Age of Mammals*, pp. 555, 556.

made at certain points of the chain, it seems advisable to raise Professor Osborn's *Anchitheriinæ* and *Hyracotheriinæ* to the rank of families, so that the horse-line will be represented by the three families *Equidæ*, *Anchitheriidæ*, and *Hyracotheriidæ*.

Of these the *Anchitheriidæ* will be characterised by the retention of functional lateral toes, by the shortness of the crowns of the cheek-teeth and their open valleys, unencumbered by cement, and by incompleteness of the bony ring round the eye-socket. The members of this family are of special interest as indicating the passage from small marsh-dwelling animals to types fitted for browsing in forests; these last passing in their turn into the grazing and plain-dwelling *Equidæ*. Writing from this point of view of the Miocene epoch in North America, Professor Lull[1] remarks that—

"This was a time of continental elevation and great expansion of our western prairies and a consequent diminution of the forest-clad areas. Many mammals otherwise fitted for survival, such as the titanotheres whose remains are very numerous in the Oligocene beds, were unable to meet the new conditions because of their very perfect adaptation to softer herbage, and thus became extinct. This was also true of certain horses, such as *Hypohippus*, but the great majority were more plastic and in

[1] *Op. cit.*, p. 177.

consequence underwent a remarkable development, during this period reaching the culmination in numbers and kinds."

The aforesaid *Hypohippus*, typified by *H. osborni* of the North American Miocene, is the culminating development of the anchitherine group, and is believed to have died out without giving rise to descendants. Neither can its precise forerunner be determined, for its fore-foot, in which the lateral toes were evidently functional and touched the ground, retains minute rudiments of the toes corresponding to the human thumb and little finger (first and fifth of the full typical series of five), which are lacking in the earlier Oligocene genera. From the structure of the feet, which indicate an animal suited to soft ground rather than hard, grassy plains, and its broad, low-crowned cheek-teeth fitted only for browsing on succulent herbage, *Hypohippus* has been called the browsing or forest horse. This animal was of relatively large size for its time, standing 10 hands at the withers.

Its remains occur in the Loup Fork beds of Southern Dakota and Montana; but Professor Osborn[1] is of opinion that certain remains from the Tertiary strata of Central China indicate animals closely allied to, if not identical with *Hypohippus*. This is very important in connection with the view

[1] *Op. cit.*, pp. 297, 332.

that Eastern Asia was the original home of the horse-group; and it derives additional importance from Professor Osborn's further suggestion that *Pliohippus* may likewise be represented in the Chinese Tertiary fauna.

The American genus *Parahippus*, which according to Professor Osborn ranges in time from the Lower Pliocene to the Upper Oligocene, although Dr. Lull records it only from the Miocene Loup Fork beds, has short-crowned cheek-teeth resembling these of *Hypohippus* in general characters, but differing in several structural details. Among these differences may be noticed the strong ribbing of the external wall of the outer columns of the upper milk-molars. For other details the reader may refer to an article by Mr. J. W. Gidley.[1] *Anchippodus* and *Desmathippus* appear to be synonyms of this genus. A peculiarity of the short-crowned upper molars of *Parahippus* which cannot be passed over without mention is the presence in their open valleys of an exceedingly thin layer of cement; this being the first appearance of a substance which, as shown above, takes a large and important share in the structure of the molars of the modern horse. This layer is absent in *Archæohippus*, of the Miocene of Oregon, a small animal with cheek-teeth resembling those of the undermentioned *Mesohippus*, but

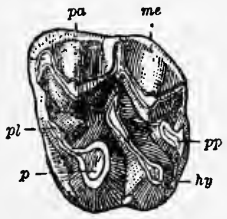
[1] *Bull. Amer. Mus. Nat. Hist.*, vol. xx. p. 192, 1904.

distinguished by the presence of a large preorbital pit in the skull.

Akin to *Hypohippus*, which was at one time regarded as inseparable from the Old World genus, is the European *Anchitherium*, typically represented by *A. aurelianense* from the Middle Miocene freshwater beds of Sansan, in Gers, France, and other equivalent continental formations, which was known to science long before the discovery of the allied American forms. *Anchitherium* was an animal of the approximate size of a sheep, and, in addition to its broad, short-crowned cheek-teeth, is specially characterised by the rudiment of the pit, or "mark," in the centre of the summits of the crowns of the incisor teeth, which, as we have seen, attains such a large development in the modern horse and its relatives. In *Anchitherium* the pits were, however, developed only in the permanent incisors. The lateral toes in each foot are considerably smaller than the central one, but probably touched the ground in walking. Another feature is that the ulna in the fore-limb and the fibula in the hind one form complete although slender bones, which are, however, severally united with the radius and tibia. In the horse they are represented only by their upper extremities. In many respects *Anchitherium* and its relatives approximate to the well-known *Palæotherium*, of the European Oligocene, and the two

groups have been included in the same family *Palæotheriidæ*. Since, however, the palæotheres seem to form a non-progressive line of their own while the anchitheres are evidently ancestral to the horses, it seems preferable to keep them apart; in fact, to take a middle course between those who class *Anchitherium* in the *Palæotheriidæ* and those who include it in the *Equidæ*. The range of the genus extends from France to Bavaria and Austria.

In the John Day beds which connect the



Left Upper Molar Tooth of *Anchitherium*
pa, paracone; *me*, metacone; *pl*, protoconule; *pp*, paraconule; *p*, anterior pillar, or protocone; *hy*, posterior pillar, or hypocone

Miocene with the Oligocene of North America, *Anchitherium* is represented by the nearly related *Miohippus*. This genus comes very close to the undermentioned *Mesohippus* of the White River Oligocene, but is represented by species of larger size (and therefore nearer *Anchitherium*), the typical one standing about 6 hands (24 inches) at the shoulder. The main differences, other than size, between the two genera are to be found in the

circumstances that the splint representing the fifth toe on the outer side of the fore-foot is smaller in *Miohippus* (pl. i. fig. 2) than in *Mesohippus*, and also that the cheek-teeth are somewhat more complex. The figure on p. 267 of an upper molar of *Anchitherium* illustrates the elements which go to form the constituents of the horse's molar.

As will be inferred from the preceding paragraph, *Mesohippus* differs from *Anchitherium* by the presence of a rudiment of the outermost or fifth digit of the fore-foot, while it is further distinguished by the absence, or at all events very slight trace, of the pits in the crowns of the incisors. Yet another feature is the presence on the heel-bone, or calcaneum, of a small facet for the articulation of the fibula, which is thus proved to be complete. It should be added that in *Anchitherium*, *Miohippus*, and *Mesohippus* the "wolf-tooth," that is, the first premolar, of the horse is fully developed in both jaws, although considerably smaller than the second premolar. As canines were developed in both jaws, the full typical series of 44 teeth was present, viz.: *i.* $\frac{3}{3}$, *c.* $\frac{1}{1}$, *p.* $\frac{4}{4}$, *m.* $\frac{3}{3}$. The typical *Mesohippus bairdi*, from the Oligocene of Dakota, was a slenderly built animal, apparently well adapted for speed, but standing only about $4\frac{1}{2}$ hands (18 inches) at the withers. *M. intermedius* was a larger but apparently unprogressive type.

The last genus referable to the *Anchitheriidæ* appears to be *Anchilophus*, of the Upper Eocene of Europe, which seems to connect in some degree the preceding genera with the undermentioned *Pachynolophus*, so far at least as the cheek-teeth are concerned; the limbs being imperfectly known. All the species were small.

When Sir Richard Owen,[1] in the year 1839, described the imperfect skull of a small ungulate mammal, of the approximate size of a fox, from the Lower Eocene London Clay of the cliffs at Studd Hill, near Herne Bay, Kent, under the name of *Hyracotherium leporinum*, he had no conception of the epoch-making importance of the discovery. Indeed, the serial position of the genus, which is now known to be the most primitive member of the horse line, could not be even approximately determined, its describer believing it to be most nearly related to a small Eocene pig-like animal known as *Chœropotamus*. Subsequently, when its affinities became better known, the genus was placed in the extinct family *Lophiodontidæ*, typified by the genus *Lophiodon* of the Middle Eocene of Europe. The lophiodons are, however, now known to be related to the tapirs, which form a line quite distinct from the horse-group. By Professor Osborn the hyracotheres are included in the same family

[1] *Trans. Geol. Soc. London*, ser. 2, vol. vi. p. 203; see also *British Fossil Mammals and Birds*, London, 1846, p. 419.

as the *Equidæ*, but, as already mentioned, this is not a satisfactory arrangement; and the genus is accordingly regarded here as the type of a distinct family—the *Hyracotheriidæ*.

The members of this family are small and primitive perissodactyle ungulates characterised by the presence of four front and three hind toes, low-crowned cheek-teeth, of which the upper molars are usually much more complicated than the premolars, and carry two oblique transverse crests, each partially divided into two cusps, and connected together by a longitudinal outer wall, a complete ulna and fibula in the limbs, and the socket of the eye entirely open behind. In place of the cannon-bone of the horse, the basal portion of the hind-foot is formed by three metatarsal bones, of which the lateral pair are not smaller or shorter than the middle one; a similar structure obtaining in the case of the three main digits of the fore-foot, where the basal bones are known as metacarpals. In both limbs the lateral toes touched the ground, the whole foot being thus adapted for walking on the borders of swamps or marshes or the muddy or sandy shores of lakes.

From the simple upper molar of *Hyracotherium*, with practically six columns on the crown, which coalesce into a pair of cross-crests and an outer wall, is derived by imperceptible gradations the tall and complex molar of the horse; the evolution

of the individual teeth being accompanied by a progressive increase of the premolars, till these, with the exception of the first of the series (which undergoes degeneration), in place of being small and simple, become as large and complex as the molars.

It is noteworthy that in Europe the *Hyracotheriidæ* appear to have died out at the close of the Eocene epoch without leaving descendants; if, however, the palæontology of Eastern Central Asia were known, we might find a transition to the *Equidæ* as complete as in North America.

The latest and most specialised member of the *Hyracotheriidæ* appears to be the imperfectly known *Epihippus* of the Upper or Uinta Eocene of Utah, where it is represented by the two species *E. gracilis* and *E. mutensis*. From the other American genera of the family *Epihippus* is distinguished by all the upper premolars, with the exception of the first, being as complex as the molars; the cross-crests being nearly complete. The lateral toes of both fore and hind feet are relatively smaller than in the undermentioned earlier genera, and would thus seem to have taken a smaller share in supporting the weight of the body. It is somewhat remarkable that in the matter of size the two species mentioned above are a little inferior to the representatives of the earlier genera. *Lophiotherium*, of the Upper Eocene of Europe,

seems to be closely allied to *Epihippus*, having upper premolars of the same complex type.

The Middle, or Bridger, Eocene of North America has yielded remains of animals referred to two distinct genera, namely *Orohippus* and *Heliohippus*, of which the latter is known only by the teeth. Whether these are truly distinct, or whether they are really separable from the contemporary European *Pachynolophus*, which was named at a much earlier date, may, however, be a matter of opinion. In justification of this assertion it may be well to mention that the limitations of genera and larger groups of animals are purely arbitrary, and therefore dependent in great measure on individual opinion.[1]

Orohippus includes several species, such as *O. agilis* and *O. major*. In structure these show a slight advance on the undermentioned *Protorohippus*, and are likewise slightly superior in size. The foot-structure is much the same in the two, but the cheek-teeth are rather more complex, the third and fourth upper premolars being molar-like, and the second approximating to the same type. The gap between the front and the cheek-teeth is also somewhat longer.

The last group of the family is represented by

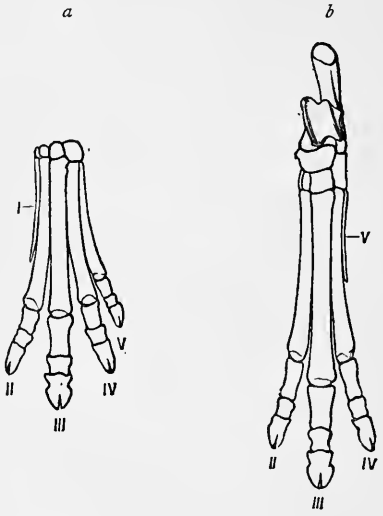
[1] See an article by Mr. L. Clark, "On the Purpose and some Principles of Systematic Zoology," in the *Popular Science Monthly*, September 1911.

certain Lower Eocene species which have been referred to the three genera *Protorohippus*, *Eohippus*, and *Hyracotherium*, of which the last (also known as *Pliolophus*) is European, while the other two are American. Whether they may not all be included in *Hyracotherium* is a matter of individual opinion. The species described as *Protorohippus ventricolus*, from the Wind River Eocene, was somewhat larger than *Eohippus pernix*, standing about $3\frac{1}{2}$ hands (14 inches) at the shoulder, and having rather longer limbs, in the front pair of which the vestige of the thumb, or first toe, seems to have disappeared, while the shortening of the fifth, or outermost, toe is another step in the direction of a three-toed foot. In the upper cheek-teeth there is fuller development of the cross-crests, and while the fourth premolar is molar-like, the third is partially so. Hitherto remains of the genus have been found only in Colorado and Wyoming.

Eohippus, as represented by *E. pernix*, of the Wasatch Eocene of North America, has been so well described by Dr. Lull,[1] that his words may be quoted *in extenso*. After observing that the upper cheek-teeth are very similar to those of the allied European genus, he goes on to say that they display a sign of advance "in that the cross-crests are somewhat more distinct than in *Hyracotherium*, and, unlike the latter, the fourth premolar is

[1] *Op. cit.*, p. 171.

beginning to assume the form of a true molar. The hand [fore-foot] bore four digits, with a vestige of the first (thumb) in the form of a splint-bone probably entirely concealed within the skin. The more progressive hind-foot had but three toes, with a remnant of the fifth.



Front View of the Bones of the Left Fore (*a*) and Hind (*b*) Feet of the American *Eohippus pernix*, ½ natural size

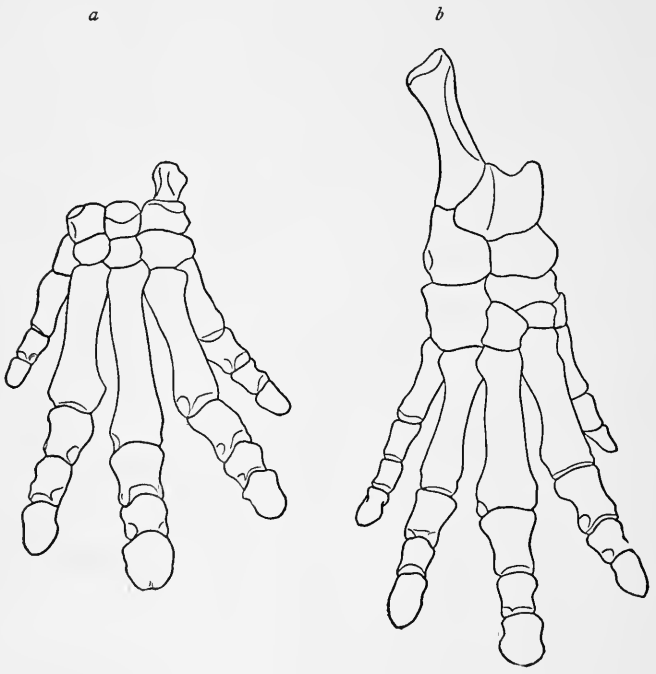
"*Eohippus* was a small animal about eleven inches in height at the shoulder, and in general suggestive of the carnivores rather than of the ungulates of to-day. The back was arched, the head and neck were short, and the limbs of moderate length, showing no especial adaptation for speed. This genus has a remarkable

geographical range, having apparently originated in Western Europe (England) and migrated by way of Asia and what is now Bering Strait as far south-east as New Mexico. This migration of *Eohippus* shifted the scene of the evolutionary drama to our own country [America], for, while the remains of succeeding genera are increasingly numerous in North American rocks from the Wasatch on, it is only from time to time that European representatives appear, in each case evidently derived from migratory North American types."

Lastly we have the European *Hyracotherium*, which, as mentioned above, apparently differs from the allied American genus solely by the somewhat simpler character of the upper cheek-teeth, in which the cross-crests still retain their two constituent tubercles. Remains of the typical *H. leporinum* have been obtained from the London Clay near Herne Bay, Sheppey, and Harwich (*Pliolophus*), and also from the Red Crag of Suffolk, which, as in this case, often contains fossils washed out of the London Clay. The remains include several more or less imperfect skulls and lower jaws and one example of the femur.

Here our knowledge of the evolutionary history of the horse comes abruptly to an end. It is true, indeed, that the late Professor E. D. Cope hailed a still earlier animal, *Phenacodus primævus*, of the basement, or Puerco, Eocene of America, as the

ultimate ancestor of the horse. But, as pointed out by Dr. Lull,[1] this animal is far too large, and in some respects too specialised, to have occupied such a position. Nevertheless, its five-toed feet



Front View of the Bones of the Right Fore (*a*) and Hind (*b*) Feet of the American Eocene *Phenacodus primævus*, $\frac{1}{3}$ natural size

afford a fair idea of what those of the ultimate ancestor may be expected to have been like.

Phenacodus belongs to a group of early and generalised ungulates forming a suborder—the

[1] *Op. cit.*, p. 163.

Condylarthra—of lower grade than either Perissodactyla or Artiodactyla. All the members of this group had five-toed fore and hind feet, and likewise rested a considerable portion of the sole upon the ground in the original plantigrade fashion—a feature in which they differ markedly from the horse and its relatives, which walk only on the very tips of their toes in the extreme of the modern digitigrade style. The two series of small bones of the wrist (carpus) and ankle (tarsus) joints are also arranged in distinct vertical rows, without that interlocking which characterises these portions of the skeleton in the Perissodactyla.

In concluding this chapter brief reference may be made to a few of the more striking features which characterise the long chain of progressive evolution from the Eocene *Hyracotherium* to the modern *Equus*. Two factors have evidently been predominant in guiding this evolution, namely, the necessity of collecting and assimilating food and of attaining a high degree of speed. "To the one," as Dr. Lull remarks, "the horse owes the marvellous perfection of the grazing mechanism, as seen in the lengthened jaws and in the teeth; to the other, the fleet limbs and graceful contour of the body and the increase in stature. These adaptations are entirely mechanical, and, while tending toward greater and greater perfection on the whole, are not always of a progressive

character ; as the loss of side-toes is distinctly retrogressive."

The adaptation for speed is most noticeable in the progressive lengthening of the limbs, and the gradual discarding of the lateral toes. The limb-elongation is most marked in the lower segments, more especially the foot ; the thigh-bone, or femur, and the humerus, or upper bone of the fore-leg, displaying much less proportionate lengthening. This causes the powerful muscles necessary to work the limbs to be situated close to, or even within, the body ; while they act upon the extremities by means of the long, slender tendons, which are as tough and elastic as steel, and whose development in the modern racehorse is expressed in horse-dealing language as "plenty of bone." Concurrently with these changes in the bones of the limbs, the sole of the foot is gradually raised from the ground, till eventually the whole weight of the body rests on the tips of the toes, whose terminal armament becomes modified from a narrow claw or nail into a broad hoof. Apparently, in herbivorous animals adapted for running on hard ground, this elevation of the sole of the foot is always accompanied by a reduction in the number of the toes, for we find the same thing occurring in antelopes, deer, and giraffes, although in a somewhat different fashion and to a rather less marked degree.

All these changes culminate in producing not only a strong and yet graceful type of limb, moving rapidly in the same fashion as a short pendulum, and thus combining rapid movement with a long stride, but they also cause the centre of gravity of the body to be raised high above the ground, which is likewise a mechanical advantage in galloping.

"The pendulum-like motion of the limbs," writes Dr. Lull, "being all in one plane, the joints become pulley-like through the formation of interlocking tongues and grooves, which effectually limit any lateral motion. There is also a reduction of the ulna in the fore-arm and of the fibula in the lower leg, as these bones, especially the former, are associated with more varied movement.

"In this evolution the hind-foot is the more progressive, as the fore-limb retains its general utility for a longer time. Finally, however, after vast ages, the fore-foot overtakes the hind, and thenceforth the degree of evolution in each is the same. Still, it is curious to note that, among living horses, in instances of reversion to ancestral conditions the fore-foot is more apt to exhibit well-developed atavistic toes, showing that in it the reminiscent tendencies are stronger."

As regards the evolution of the teeth, Dr. Lull has summarised the case so graphically that his own words may once more be quoted in full:—

"In the evolution of the teeth," he writes, "we

again find both progression and retrogression, as in the modern horse the canine and the first premolar are alike reduced to vestiges and are often entirely absent. The early horses had grinding teeth of a very generalised pattern; indeed, it is often a matter of great difficulty to distinguish the teeth of these horses from those of the ancestors of what are now widely removed orders of mammals. On their crowns these teeth bore little cusps or prominences, which in the quadrangular molars just begin to grow together into the crests that later form the greater portion of the grinding surface. The premolars are at first simple in character, but as time goes on they become successively molar-like, beginning with the hindermost. This is not true of the anterior one, which, as we have seen, is finally reduced to an often disappearing remnant.

"During the forest-dwelling period in the history of the horses, and while they lived upon succulent meadow-grasses, the teeth, though increasing in size with the entire organism, remain short-crowned. Upon the expansion of the prairies, however, and the adoption of the harsh grasses as a main staple of food, the tooth of the horse changes in character, becoming elongate, prismatic in shape, and the depression lying between the crests filling with a substance known as cement, which strengthens the entire tooth. The result is a long columnar structure made up of

three sorts of material of different degrees of hardness—enamel, dentine, and cement, which through differential wear always present a roughened grinding surface.

"During the early life of the horse the tooth is continuously growing, and, in spite of the fact that it must constantly move outward to compensate for wear, the root penetrates deeper and deeper within the jaw until fully formed. The outward movement still continuing, the tooth now gradually shortens until in extreme old age it is practically consumed. The total length of the tooth is nicely calculated to meet the needs of a full measure of life."

That all these marvellous changes and adaptations are not due to any mere "blind struggle for existence" or "survival of the fittest," but that they were directly designed and controlled by an Omniscient and Omnipotent Creator, is the settled and final opinion of the author of this volume.

INDEX

ABNORMALITIES in horse, 59
African wild ass, 220
Age-determination by teeth, 31
Albinism, 54
Anau horse, 95
Anchilophus, 269
Anchippodus, 265
Anchitheriidæ, 263
Anchitherium, 266
Arab horse, 150
Archæohippus, 265
Artiodactyla, 3
Asinus equuleus, 85
Asinus fossilis, 100
Ass, 215; wild, 218; Nubian, 220; Somali, 220; Socotran, 221; Indian, 223; Poitou, 223

BALEARIC horse, 137
Barb, 164
Bartlett's Childers, 167
Batak pony, 111
Belgian horse, 140
Bible horses, 145
Birthplace of *Equidæ*, 68
Bontequagga, 195; white, 202
British horses, 117
Burchell's zebra, 196
Burmese pony, 111
Byerley Turk, 167

CALLOSITIES, 44
Cannon-bone, 14
Carpal callosities of wart-hogs, 49
Carpal pores of pigs, 49
Carpus, 17
Celtic pony, 100, 122
Cheek-teeth of horse, 33
Chestnuts, 44
Chigetai, 180
Cleveland Bay, 128
Clydesdale horse, 131
Coat-colour, inheritance of, 57
Coat-colour and speed, 59
Coffin-bone, 16
Coloration of horse, 54
Colouring of *Equidæ*, 52
Colouring, protective, in zebra group, 205
Connemara ponies, 120
Crumen, 23

DAMARA zebra, 214
Daow, 213
Dappling in horses, 53
Darley Arabian, 167
Dartmoor ponies, 119
Dauw, 213
Desert type, 95
Desmathippus, 265
Distribution of horse tribe, 66
Dongola horse, 162, 165
Donkey, 215
Drenthe horses, 129, 142
Dun horse, 105
Dvele-hest, 122
Dziggetai, 180

ECLIPSE, 167
Eel-dun horse, 105
Eohippus, 273
Epihippus, 271
Equæ indomitæ, 118
Equæ silvestres, 118
Equidæ, 12; distribution of, 66; birthplace of, 68
Equus, 4, 244
Equus adamiticus, 93; *africanus*, 162, 220; *agilis*, 100; *annectans*, 199; *antiquorum*, 197; *asiaticus*,

162 ; *asinus*, 215 ; *berberensis*, 192 ; *boehmi*, 198 ; *burchelli*, 196 ; *caballus*, 103 ; *castaneus*, 182 ; *celticus*, 100, 121 ; *chapmani*, 198 ; *crawshayi*, 199 ; *foai*, 209 ; *fossilis*, 92, 95 ; *fraternus*, 246 ; *germanicus*, 95, 97 ; *giganteus*, 246 ; *goldfinchi*, 202 ; *gracilis*, 100 ; *granti*, 199 ; *grevyi*, 190 ; *greyi*, 195 ; *hagenbecki*, 91 ; *hartmannæ*, 219 ; *hemionus*, 180 ; *hemippus*, 184 ; *indicus*, 182 ; *jallæ*, 199 ; *kiang*, 178 ; *latifrons*, 97 ; *libycus*, 100, 162 ; *maculatus*, 190 ; *namadicus*, 116 ; *nehringi*, 95, 96, 124 ; *onager*, 181 ; *peuricei*, 214 ; *plicidens*, 93 ; *przevalskii*, 87, 92, 107 ; *pumpellii*, 95, 97 ; *quagga*, 192 ; *robustus*, 95, 101 ; *selousi*, 198 ; *sivalensis*, 247 ; *somaliensis*, 220 ; *spelæus*, 94, 97 ; *stenonis*, 246 ; *tæniopus*, 220 ; *wahlbergi*, 197 ; *zebra*, 211

Ergot, 41
Erythrism, 54
Even-toed ungulates, 2
Exmoor ponies, 119

Feet of horse, 13
Feet of ungulates, 5
Feral horses, 170
Fetlock, 16
Fjord-hest, 122
Flying Childers, 167
Foa's zebra, 210
Forehead-star of horse, 55
Forerunners of horse, 239
Forest type, 95, 96, 101
Frog, 41

Gallop of horse, 63
Galloway, 127
Garron, 127
Ghor-khar, 180, 182
Godolphin Barb, 167
Great horse, 131
Grévy's zebra, 190

Hanoverian horse, 142
Hartmann's zebra, 214
Heliohippus, 272
Hindu myths of horse, 69
Hinney, 221
Hipparion, 256
Hippidium, 251
Hippodactylus, 260
Hippotigris, 185
Hippotigris hartmannæ, 214
Hock, 17
Hoof, 41
Horns in horses, 60
Horse, origin of name, 1 ; family, 12 ; structure of foot, 13 ; specialisation, 18 ; skull, 19 ; preorbital depression, 22 ; teeth, 27 ; succession of teeth, 31 ; age-determination by teeth, 31 ; cheek-teeth, 33 ; succession of teeth, 34 ; masticating power, 38 ; longevity of, 39 ; hoof of, 41 ; frog of, 41 ; ergot of, 41 ; chestnuts or callosities of, 44 ; tribe, colouring of, 52 ; dappling of, 53 ; coloration of, 54 ; forehead-star, 55 ; inheritance of coat-colour, 57 ; abnormalities in, 59 ; horns in, 60 ; gallop, 63 ; Hindu myths of, 69 ; wild, 71 ; Stone Age, 77, 92 ; Prehistoric, 77, 92 ; Przewalski's, 87 ; Anau, 95 ; desert type, 95 ; Solutré, 97 ; Madelaine, 97, 99 ; forest type, 95, 96, 101 ; steppe type, 95, 97, 99 ; plateau-type, 100 ; dun, 105 ; Norwegian, 105, 122 ; Kathiawar, 113 ; Turkoman, 113 ; Tibetan, 114 ; Narbada, 116 ; British, 117 ; pack, 119 ; Cleveland, 128 ; Suffolk, 129 ; Clydesdale, 131 ; Great, 131 ; shire, 131 ; Schlettstadt, 136 ; Balearic, 137 ; Percheron, 138 ; Belgian, 140 ; Hanoverian, 142 ; Hungarian, 143 ; Kalmuk, 144 ; in the Bible, 145 ; Turkish, 145 ; Turkoman, 148 ; Spanish, 149, 165 ; Kurdish, 147 ; Persian, 147 ; Arab, 150 ; Barb, 164 ; Dongola, 162, 165 ; thoroughbred, 166 ; feral, 170
Hybrids, 225
Hyperhippidium, 253
Hypohippus, 264

Hyracotheriidæ, 269
Hyracotherium, 270

INDIAN ass, 223
Indian ghor-khar, 182
Inheritance of coat-colour, 57

JAVA pony, 112
Jennet, 165

KALMUK horse, 144
Kathiawar horse, 113
Kiang, 178
Knee, 17
Kobdo onager, 183
Kulan, 180
Kurdish horse, 147

LACHRYMAL gland, 23
Larmier, 23
Longevity of horse, 39

Macrauchenia, 33
Madelaine horse, 97, 99
Mallenders, 44
Manipuri pony, 111
"Mark" in teeth, 29
Markham Arabian, 166
Mastication, 38
Melanism, 54
Merychippus, 254
Mesohippus, 268
Milk-teeth, 30
Miohippus, 267
Molars, 33
Mongolian tarpan, 82, 107; pony, 108
Mule, 225

NARBADA horse, 116
Neohipparion, 258
New Forest ponies, 118
Norwegian horse, 105, 122
Nubian wild ass, 220

ODD-TOED ungulates, 3
Onohippidium, 251
Orkney ponies, 126
Orohippus, 272

Pachynolophus, 272
Pack-horse, 119
Parahippus, 265
Pastern, 16
Penrice's zebra, 214
Percheron horse, 138
Perissodactyla, 3
Persian ghor-khar, 183
Persian horses, 147
Persimmon, 167
Phacochœrus, carpal callosities, 49
Phenacodus, 275
Pigs, carpal pores, 49
Pillars of teeth, 36
Plateau type, 100
Pliohippus, 250
Pliolophus, 275
Poitou ass, 223
Pony, Celtic, 100, 122; Mongolian, 108; Yarkand, 110; Batak, 111; Burmese, 111; Manipuri, 111; Javan, 112; New Forest, 118; Exmoor, 119; Dartmoor, 119; Connemara, 120; Welsh, 120; Shetland, 124; Orkney, 126
Prehistoric horse, 77, 92
Premolars, 33
Preorbital depression, 22
Protective colouring, 205
Protohippus, 254
Protorohippus, 273
Przewalski's horse, 87, 107

QUAGGA, 184, 194

RHINOCEROS, 5
Rhinocerotidæ, 5

SALLENDERS, 44
Schlettstadt horse, 136
Shetland ponies, 124
Shire horse, 131
Skull of horse, 19
Socotran ass, 221
Solutré horse, 97
Somali wild ass, 220
Spanish horses, 149, 165
Specialisation of horse, 18
Speed and coat-colour, 59
Splint-bones, 14
Steppe type, 95, 97, 99
Stockwell, his gait, 62

Stone Age horse, 77, 92
Stud, 52
Succession of teeth in horse, 31, 34
Suffolk horse, 129
Syrian onager or wild ass, 184

TANGHAN, 114
Tapir, 6
Tapiridæ, 6
Tarpan, 71, 79, 82, 95, 107
Tarpani, 82
Tarsus, 17
Teeth of horse, 27, 33 ; wearing of, 39
Third trochanter, abnormal, 62
Thoatherium, 18
Thoroughbred horse, 166
Tibetan horse, 114
Turkish horse, 145
Turkoman horse, 113, 148

UNGULATA, 2

WARD'S zebra, 202
Wart-hogs, carpal callosities, 49
Wearing of teeth, 39
Welsh ponies, 120
White bontequagga, 202
Wild ass, 218 ; Syrian, 184
Wild horses, 71, 79
Wolf-tooth, 34

YARKAND pony, 110
Yo-to-tze, 86

ZEBRA, 187, 210 ; Grévy's, 190 ; Burchell's, 196 ; Foa's, 210 ; Hartmann's, 214 ; Damara, 214 ; Penrice's, 214

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E. G. Conklin, 10/29/22.

"What then is the conclusion for the whole matter? Simply this. Evolution is only a process, nothing more. God is as necessary in evolution as without it. There were atheists before Darwin, and there will be atheists after Bryan. Evolution did not make atheism. The conclusion which the religious minded person must hold, as I see it, is this. It does not matter what the process was if only we believe that there was a purpose in it all, that it was not mere accident. If only we believe that there was a purpose in it all then it seems to me that we need not worry about anything else. I believe that those who think clearly and logically and sanely on this subject will be compelled to come to the conclusion which many eminent scientists have already come to, that there is no power, no law, no purpose, no causation in the world that is not a manifestation of God."

"What do we know after all? Do we absolutely know anything of a certainty? Not at all. Our knowledge is based upon probabilities of a higher or lower order. Sometimes these probabilities are so tremendously arresting that we say that we feel sure. And yet no scientist ever feels so sure of anything that he is not ready to revise his opinion on that as soon as the evidence is presented that would cause him to revise his opinion. ——— You do not have certainty of what you are going to do tomorrow but you act on faith. You accept the probabilities and go ahead. We walk by faith and not by sight, or we do not walk at all in this world. ——— "We walk by faith," says the Apostle, and it is the essence of faith that one is willing to act upon his beliefs even though those beliefs are not capable of demonstration!

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